WEST VIRGINIA
GEOLOGICAL SURVEY

J. A. P. McGinnis
Sept 7-1926

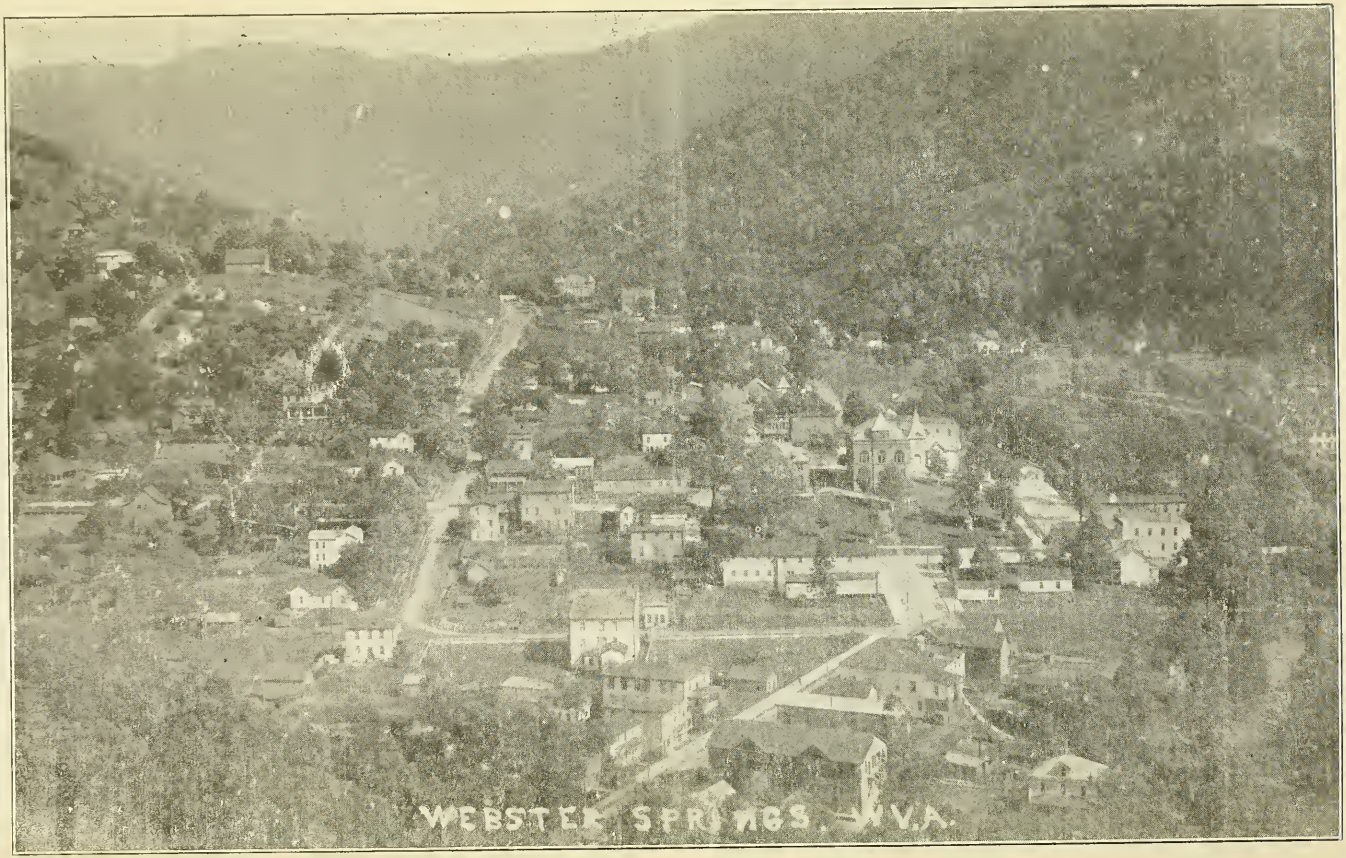

PLATE I.—View of Webster Springs looking south up Elk River, which is visible in right foreground; Topography of Pottsville, Mauch Chunk, and Greenbrier Limestone Series.

WEST VIRGINIA
GEOLOGICAL SURVEY

Webster County And Portion of Mingo District, Randolph County, South of Valley Fork of Elk River.

By

DAVID B. REGER, Assistant Geologist,

Assisted in Office by

R. C. TUCKER and MARGARET BUCHANAN.

I. C. WHITE, State Geologist.

1920.

MORGANTOWN PRINTING & BINDING COMPANY
MORGANTOWN, W. VA.
1920

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(June 10 to Sept. 14, 1918)

BERT H. HITE.....*Chief Chemist*

B. B. KAPLAN.....*Assistant Chemist*

JAN B. KRAK (to Jan. 31, 1920).....*Assistant Chemist*

J. LEWIS WILLIAMS.....*Chief Clerk*

MARIE STENGER.....*Stenographer*

LETTER OF TRANSMITTAL.

To His Excellency, Hon. John J. Cornwell, Governor of West Virginia, and President of the West Virginia Geological Survey Commission:

SIR:

I have the honor to transmit herewith the Detailed Report and Topographic and Geologic maps covering Webster County. The data published in this large volume, collected and arranged in proper sequence with great skill and care by Mr. Reger and his assistants, will prove of much value, not only to the citizens of Webster County, and to West Virginians generally, but also to those residing in other States who already own lands in this county. Then, too, constant inquiries come to the office of the Survey from nearly every State of the Union made by parties seeking investments in undeveloped mineral and timber lands such as exist in large quantities in counties situated like Webster, off the main transportation lines of the country. To all such, this volume and its accompanying maps will prove especially valuable.

The New River Coal Group extends from Fayette County across southern Nicholas, and northern Greenbrier into and entirely across the southern half of Webster County, but owing to lack of railway transportation has remained practically undeveloped except for local domestic use at Webster Springs, and other points, as well as for power at some of the sawmills on Sugar Creek and other points. These coals are not thick, being only 3 to 5 feet in that dimension, but from analyses made in the laboratory of the Survey appear to be of extraordinary purity, in freedom from injurious quantity of both ash and sulphur. There appear to be two of these New River beds which are more or less persistent across Webster County, the main one being the famous Sewell seam, although sometimes a third one is present. They most probably represent the Beckley and Fire Creek beds in addition to the Sewell.

The most direct route for rail transportation of these

Webster County coals to market would be an extension of the Pickens Branch of the B. & O. R. R. by a tunnel through the watershed from Pickens to Sugar Creek and down the latter to the Back Fork of Elk and on to main Elk River probably best via a tunnel through the narrow divide separating these two streams. Some of the coal beds of the Kanawha Group also reach into Webster County and have been successfully mined on the waters of Holly River, Laurel Creek and other streams where access to railways is available.

The high ridges in northern Webster catch the Allegheny coals one or two of which, the Kittanning beds, become thick and valuable.

The soil studies and maps of Webster County have already been made and will soon be published through cooperation of the West Virginia Geological Survey with the Bureau of Soils of the United States Department of Agriculture.

Special attention should also be called to the Salt Sulphur Springs and their health-giving properties so long and favorably known in the vicinity of Webster Springs, the county-seat. This Salt Sulphur mineral water is derived from shallow borings into the top of the Mountain or Greenbrier Limestone of the Mississippian series, having long been highly prized for its curative and health-giving properties. During the summer season especially, many visitors come to this little mountain resort to drink at this "fountain of youth" as many have called its health-restoring waters.

I. C. WHITE,

State Geologist.

Morgantown, W. Va.,

June 15, 1920.

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ILLUSTRATIONS.

Maps I and II in Atlas (Under Separate Cover).

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Plates.

Plates.

Figures.

AUTHOR'S PREFACE.

This book is a general geological report on Webster County. As shown by the table of contents, it contains a short historical and industrial sketch, a chapter on Physiography, six chapters on Stratigraphy, four chapters on Mineral Resources, and a chapter on Paleontology, as well as an appendix giving all available spirit-level bench marks and railroad levels in the county.

In order to describe the several coals and the oil and gas sands in their proper stratigraphic sequence, it was necessary to make an exhaustive study of the entire rock system, both surface and underground, as deep as information was available, the results of which are embodied in the text in the form of geologic sections and detailed descriptions. Some of this matter may not be of interest to the casual reader but its value to professional men conducting future coal, oil, and gas operations in the county can not be questioned and its publication is therefore justified. In each geologic section certain physical facts, including thicknesses, intervals, colors, and general characteristics of rock strata and coals, are presented just as obtained by careful research in the field, which, except for minor errors, can not be changed by subsequent investigation. These facts are followed by the author's interpretation or correlation, based in some cases on opinion where certain essential facts are lacking, and some of these will doubtless require revision after more detailed researches and prospects have been made by future workers in particular localities. On all such points the author will welcome kindly criticism and suggestions, as the aim has been to give all available facts and to draw conclusions based on present knowledge, which in many places is incomplete owing to concealed strata, or to the lack of prospects or borings or other data. The special attention of stratigraphers is called to Chapter VIII in which a general section of the Mauch Chunk Series of West Virginia is published.

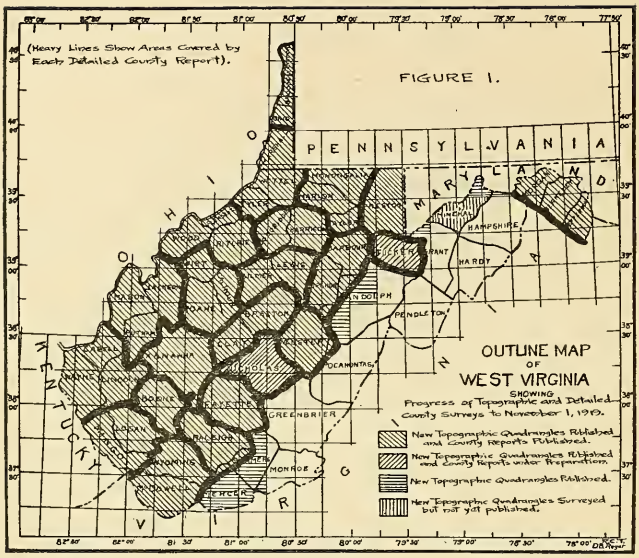

Figure 1.—Map showing progress of Topographic and Geologic Mapping in West Virginia.

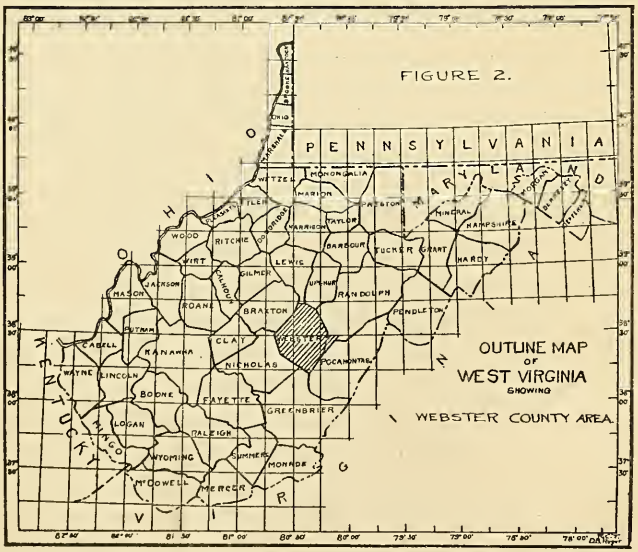

Figure 2.—Map showing location of Webster County area.

Two maps accompany the Report in a separate atlas, Map I showing the topography and Map II showing the geology. Map I is assembled and photolithographed from the standard topographic quadrangles as surveyed and published by the U. S. Geological Survey in cooperation with the West Virginia Geological Survey, certain additions and corrections, principally railroads and place names, being added by the author. Map II, made up from the same base, gives not only the outcrops of the various series and minable coals but also shows by number the exact location of all tests for oil and gas, coal test borings, and coal openings 1 to 759, inclusive, as numbered and described in the text. Besides these separate maps 24 figures appear in the text, of which Nos. 4 to 22, inclusive, are intended to show at a glance where the several coal seams are of minable thickness and purity. Since these coals are too thin or impure to be minable in certain regions it has been necessary to show approximate lines of disappearance, in referring to which it must be remembered that there are probably small areas of good coal on the barren side and corresponding areas where the coal is worthless on the side where coal is shown. In some instances where the coals are known to be patchy over a considerable area, this condition is shown by breaks in the line shading. Wherever possible detailed information should be sought from openings or borings published in the text.

The author spent the field season of 1916 making the necessary field researches for this volume, being wholly responsible for the data contained in Parts I, II, and III, except when specific acknowledgment is otherwise made in the text. In addition to the work of the author the value of the chapter on Commercial Coal has been much enhanced by the publication of the Bethlehem Steel Company's Table of Coal Analyses, the material of which was furnished the Survey through the Assistant Geologist of the company, Mr. D. D. Teets, Jr., who collected the samples in the field while engaged in a study of Webster County coals. The author has had access, also, to a comprehensive report on the coals along the West Virginia Midland Railroad, made for the Baltimore and Ohio Railroad by C. McC. Lemley, Assistant Engineer of that Company, the prospects

noted therein having been visited and the measurements verified. Many other valuable sections and analyses were likewise secured from other sources, due acknowledgment having been made in the text. It is manifestly impossible to make detailed mention of the great number of Webster County citizens who most generously furnished entertainment and local guidance often at personal inconvenience to themselves, but to all of these special acknowledgment is made both personally and in the name of the State whose interest was served. Special acknowledgment is made to Col. John T. McGraw, President of the West Virginia Midland Railroad, for special train service, maps, photographs, and data, and cordial cooperation in making prospects at the request of the author.

Of the photograhps published in the Report, Plates Nos. IX and XI-XXIII, inclusive, were furnished by Col. John T. McGraw, of Grafton, W. Va. Nos. XXVIII and XXIX by Harry H. Russell, of Gauley Mills, Assistant Superintendent of the West Virginia Wastewood Chemical Company, Nos. XXXII and XXXIII by the U. S. Bureau of Mines, and Nos. I-VI, inclusive, were secured from Mr. R. Anderson, of Webster Springs, the remainder being by members of the Survey.

Part IV, treating of the Paleontology, is the work of Dr. W. Armstrong Price, Paleontologist, the collections, which are scanty, having been made in the field by the author.

The chemical analyses and calorific tests, except as otherwise specified in the text, were made by J. B. Krak, Assistant Chemist, working under the direction and with the assistance of B. H. Hite, Chief Chemist, in the laboratory of the Survey.

Credit is due to Miss Margaret Buchanan and R. C. Tucker for office assistance in preparing the Report, most of the figures and the geologic details on Map II, as well as a large amount of statistical matter of the text having been done by the former while the latter is responsible for the proof-reading of the volume as well as for certain figures, photographs, statistical details, and certain portions of the map, and for the Index.

Finally, the author expresses his obligation to Dr. I. C. White, State Geologist, whose constant supervision and valuable suggestions have added greatly to the value of this Report.

DAVID B. REGER.

Morgantown, W. Va.,
February 24, 1919.

ERRATA.

Page 10, line 19 from top, for "Ysar," read "Year."
Page 16, line 19 from top, for "Mills," read "Mill."
Page 79, line 11 from bottom, for "cannally," read "cannelly."
Page 129, line 2 from bottom, for "18," read "13."
Page 151, line 16 from top, for ".", read ",".
Page 294, line 20 from top, for "Upper," read "Middle."
Page 325, line 4 from top, for "Cowgar," read "Cowger."
Page 427, line 9 from top, for "535," read "535A,"
Page 447, line 14 from top, for "Holly," read "Fork Lick."
Page 458, line 11 from top, for "644," read "No. 644."
Page 501, line 19 from bottom, for "ml.", read "mi.".
Page 501, line 2 from bottom, for "4-R", read "4-Rc."
Page 503, line 13 from bottom, for "5.00," read "6.00."
Page 536, line 1 from top, for "CHATPER XI," read "CHAPTER XII.
Page 621, line 2 from top, for "Tidə," read "Tide."

PART I.

History and Physiography.

CHAPTER I.

HISTORICAL AND INDUSTRIAL DEVELOPMENT

LOCATION.

Webster County, comprising the main subject of this Report, is situated in the south central portion of West Virginia. Roughly it is a diamond-shaped area, the longer axis extending in a north and south direction between the parallels of 38° 13′ and 38° 45′ North Latitude, and the shorter axis being east and west between the meridians of 80° 11′ and 80° 41′, West Longitude from Greenwich. It is bounded on the north by Lewis and Upshur; on the east by Randolph and Pocahontas; on the south by Pocahontas, Greenbrier, and Nicholas; and on the west by Nicholas and Braxton Counties. Its area is entirely included within the drainage basins of the Little Kanawha, Elk, and Gauley Rivers, the first-named stream flowing into the Ohio River direct, and the latter two reaching it through the Great Kanawha. In addition to Webster County a small triangular portion of Randolph, lying just east of the Webster line and south of Valley Fork of Elk River, and comprising 34.64 square miles, was examined and is included in the present Report.

The geographical position of the area outlined above

may be observed from Figures 1 and 2 in this Volume and from Maps I and II, enclosed in a separate atlas accompanying this Report.

TRANSPORTATION.

Water Ways.

Although drained by portions of seven rivers, Webster County does not have water transportation. Before railroads were built into the county logs were floated in great numbers down the Holly, Elk, Gauley, Williams, and Cranberry Rivers, and even down many of their tributaries at flood times, but this method has now been abandoned and the swift currents preclude any hope of making them into permanent water ways by means of locks and dams.

Steam Railroads.

Baltimore and Ohio Railroad. — The Richwood Branch of the Baltimore and Ohio Railroad, which extends in a north and south direction from Clarksburg to Richwood, Nicholas County, a distance of 121 miles, passes through the western edge of Webster, entering at Prestonia and leaving its territory at Allingdale, the distance between the two points being 25 miles. As previously described by the writer[1] this road was built by Hon. J. N. Camden, its name being the West Virginia and Pittsburgh Railroad when first built into Webster, but it was sold to the Baltimore and Ohio Company in September, 1899. The road was completed from Weston to Flatwoods in 1890 and 1891, to Camden-on-Gauley in 1891 and 1892, and to Richwood in 1899. It is a standard gauge road doing a general freight and passenger business.

West Virginia Midland Railroad. — The West Virginia Midland Railroad, tributary to the Richwood Branch of the Baltimore and Ohio at Holly Junction, Braxton County, is a three-foot gauge system, extending up Right Fork of Holly River, crossing the mountain to Elk River, and thence to Webster Springs. It was built and is largely owned by Hon.

[1]Lewis and Gilmer Report, W. Va. Geol. Survey, p. 3; 1916.

John T. McGraw, and affords general freight and passenger service, the total distance from Holly Junction to Webster Springs being 28.4 miles, of which 20.2 miles are within Webster County. Besides the main line, important branches extend up Left Fork of Holly and Oldlick Creek. The following letter from Geo. A. Hechmer, General Manager, addressed to Ray V. Hennen under date of February 24, 1916, and previously published by the Survey[2], gives a short history of the road and an account of its purposes:

"In reply to your letter of the 21st instant, I beg to state that the West Virginia Midland Railroad Company was incorporated in 1905, for the purpose of building a railroad from Sutton in Braxton County to Marlinton in Pocahontas County. In April, 1906, this company purchased and took over the Holly River and Addison Railway Company, which operated a road from Holly Junction to Webster Springs, West Virginia, and which company had purchased the Holly River Railroad Company property, and built the line from Holly in Braxton County to Hechmer on Holly River in Webster County. This company built the line from Diana, a point on its main line, to Webster Springs, with a view of developing and offering rail facilities for the visitors there in the summer months for the purpose of drinking the Salt Sulphur Waters, then and now so justly famous and well known.

"This company owes its existence to the untiring efforts of Hon. John T. McGraw, of Grafton, W. Va., who has been the prime mover and person responsible for the development of this road.

"The mileage of this company in Braxton County is 12.16 miles, and total mileage, 45 miles.

"The line from Holly to Hechmer was built in 1899, Holly to Webster Springs, 1901 and 1902, Webster Springs to Breece, 1906, Holly to Long Run, 1910, Marpleton to Coal Bank, 1911.

"There has been in addition to the above work some grading done along the main line for the purpose of standardizing the road, and some from Skelt on the Back Fork of Elk River, to connect the Pickens and Webster Springs Railroad with the West Virginia Midland R. R., with a view of opening a through line from Holly Junction to Pickens, in Randolph County.

"We have now under way plans for the complete standardizing of the road from Holly Junction to the mouth of Leatherwood Creek in Webster County, on the main Elk River, the proposed line to follow the waters of Holly River to the mouth of Grassy Creek, up

[2]Braxton and Clay Report, W. Va. Geol. Survey, p. 4; 1917.

Grassy Creek to the divide with Elk, through the hill by a tunnel 1150 feet long, and thence to Webster Springs on a very low grade against out-bound traffic."

Brooks Run Lumber Company Railroad. — The Brooks Run Lumber Railroad is a short, three-foot gauge line, tributary to the Richwood Branch of the Baltimore and Ohio at Prestonia, and extending up Brooks Creek, a distance of two or three miles, having been built in 1916 for the purpose of hauling logs.

Erbacon and Summersville Railroad. — The Erbacon and Summersville Railroad, tributary to the Richwood Branch of the Baltimore and Ohio at Erbacon, is a standard gauge line extending westward to Skyles and Birch River, Nicholas County. According to C. O. Thayer, Superintendent of the Davis-Eakin Lumber Company, of Skyles, the road was begun in 1911, there being a total of 15 miles of track, its business being principally that of hauling logs and lumber for the above-named Company.

Harmount and Hall Railroad. — The Harmount and Hall Railroad, tributary to the Richwood Branch of the Baltimore and Ohio at Wainville, is a three-foot gauge line extending eastward up Amos Run, a distance of 5 miles. It was built about 1911 for the purpose of hauling logs to the Harmount and Hall mill at Wainville.

Smoot Lumber Company Railroad. — The Smoot Lumber Company Railroad, tributary to the Richwood Branch of the Baltimore and Ohio at Arcola, is a three-foot gauge line, extending southeastward up McAvoy Run and across the summit to Gauley River about one mile west of Bolair. According to C. D. Howard, of Cowen, General Manager, the road was begun in 1910, there being at present 15 miles of track, used principally for hauling logs to the Smoot Lumber Company mill at Arcola.

Strouds Creek and Muddlety Railroad. — The Strouds Creek and Muddlety Railroad, tributary to the Richwood Branch of the Baltimore and Ohio at Allingdale, is a standard gauge line extending northwestward up Strouds Creek and across the divide a distance of 5.7 miles to Tioga, Nicholas

County, where it serves the Birch Valley Lumber Company, there being several branches into the drainage of Beaver and Muddlety Creeks. The road handles a general freight and passenger business between Allingdale and Tioga.

Cherry River Boom & Lumber Company Railroad. — The Cherry River Boom and Lumber Company Railroad, which serves the great lumber mills of the Cherry River Company at Camden-on-Gauley, Holcomb, and Richwood, is a standard gauge logging road tributary to the Richwood Branch of the Baltimore and Ohio. According to Capt. H. W. Armstrong, of Richwood, General Superintendent of the Company, the trackage now totals 40 to 50 miles. Construction was begun in 1899, when the Richwood mill was established. Of the three lines that now enter Webster County, the principal carrier is the branch that extends eastward from Richwood, up North Fork of Cherry River, crossing the divide between Cherry and Cranberry Rivers at an elevation of 3633 feet, and descending to Dogway village on Dogway Fork of Cranberry, at the extreme southern end of Webster, having been begun in 1906 and completed to Dogway in 1911, and being subsequently extended to the mouth of Dogway Fork and up the Cranberry River into Pocahontas County. A second branch starts from the Baltimore and Ohio at Cranberry Station, and extends eastward up the Cranberry River to a junction with the Dogway Branch at the mouth of Dogway Fork, having been completed in 1917. A third branch starts from the Baltimore and Ohio one-fourth mile south of Allingdale, and extends eastward up the south side of Gauley River, its ultimate destination being the timber woods on Williams River above Dyer. This branch was begun in 1917, there being 3½ miles of track completed by July of that year. Of the entire Cherry River system approximately 21.2 miles of track lie within Webster County.

Pickens and Hacker Valley Railroad. — The Pickens and Hacker Valley Railroad, tributary to the Pickens Branch of the Baltimore and Ohio at Pickens, Randolph County, is a three-foot gauge, lumber-carrying road, extending westward across a mountain divide and down Fall Run and Left Fork

of Holly River to Hacker Valley, a distance of 13 miles, its principal business being that of a log and lumber carrier for the Mayton Lumber Company at Hacker Valley, although a limited amount of freight and passenger traffic is handled, there being no regular passenger schedule. According to A. W. Ewing, civil engineer, of Pickens, it was begun by Henry Spies in 1899 and completed to Hacker Valley in 1903, being now the property of the Mayton Lumber Company.

Pickens and Webster Springs Railroad. — The Pickens and Webster Springs Railroad, tributary to the Pickens Branch of the Baltimore and Ohio at Pickens, and extending southwestward across the mountain and down Little Sugar Creek to Skelt on the Back Fork of Elk River, a distance of 17 miles, is a three-foot gauge road, its principal function having been as a log carrier for the Holly Lumber Company whose operations are now abandoned. According to A. W. Ewing, grading was begun by Senator J. N. Camden in 1893, steel was laid in 1900 and 1901, and the road was finally completed to Skelt in 1905, being first called the Pickens and Addison Railroad. This road is now the property of Col. John T. McGraw, that portion lying on Little Sugar Creek not being at present in operation. The three-mile section of track from the head of Little Sugar Creek to Pickens is operated by the **Ranwood Lumber Company,** whose tributary line branches from the parent road at the former point and extends southward to main Sugar Creek, penetrating Webster County with one-half mile of track.

Greenbrier, Cheat and Elk Railroad. — The Greenbrier, Cheat and Elk Railroad is a standard gauge line tributary to the Greenbrier Division of the Chesapeake and Ohio Railway at Cass, Pocahontas County. From Cass the road extends westward across the Back Alleghany through a mountain pass 3935 feet above sea-level, to Spruce on the head of Shaver Fork of Cheat River, where it divides into two branches, one of which extends northward down Shaver Fork to a connection with the Western Maryland Railway at Cheat Junction. The other branch extends westward through the mountain passes between the headwaters of Cheat, Tygart

Valley, and Elk Rivers, and thence down Big Spring Fork of Elk to Slaty Fork, Pocahontas County. From this point one branch extends southward up Old Field Fork of Elk River to its head. The main line from Slaty Fork extends northwestward down main Elk, passing into Randolph at the mouth of Douglas Fork and entering Webster at the Whitaker Falls and thence proceeding down the south side of the river to Bergoo village at the mouth of Leatherwood Creek. The principal function of this road at present is as a log carrier for the West Virginia Pulp & Paper Company which operates extensive lumber and pulp mills in West Virginia and other States. No general freight and passenger business is conducted but special supply trains afford a limited freight service in the territory of the road. According to Chas. W. Luke, Manager of the company operations at Cass, the road was begun in 1900, there being at present about 75 miles of track, of which 9.3 miles are in Webster County and 8.2 miles in that strip of Randolph included in this Report. Although built primarily for a logging road the grade is good enough to make it an eventual coal carrier for eastern Webster and for that portion of Randolph treated in this Report.

Highways.

Summersville and Slaven Cabin Road. — The Summersville and Slaven Cabin Road, starting at Summersville, Nicholas County, extends eastward, crossing into Webster at Allingdale, and, passing through Camden-on-Gauley, Cowen, Webster Springs, Ralph, Woodzell, and Waneta, leaves the county 2½ miles east of the latter point. Its further course is through Monterville to the Tygart Valley River at Valley Head where it turns northward down the valley, intersecting the Parkersburg and Staunton Turnpike at Huttonsville. The Slaven Cabin of early days from which the road derives its name was located on the east slope of Shaver Mountain a short distance west of the present town of Durbin. The Summersville and Slaven Cabin Road is not hard surfaced and differs but little from the usual dirt road. In eastern Webster its course in the vicinity of Woodzell and Waneta

is along the summit of Point Mountain, varying from 3,500 to 4,000 feet above sea-level, which, being one of the highest cleared ridges of the State, makes the road a great scenic highway.

Ordinary County Roads. — Webster County is served mainly by earthen roads of an inferior character, most of them being steep, narrow, and rough and faithful reflections of the topography through which they are built. That portion of the county lying southeast of Webster Springs and comprising considerable portions of the Elk, Gauley, Williams, and Cranberry River drainage areas contains no wagon roads of any description, travel being confined to rough mule trails that follow the river valleys or mountain ridges and to the logging railroads. According to Hon. A. D. Williams,[3] Chairman of State Road Bureau, the county has only 338 miles of road, this mileage being extremely small as compared with other counties of equal area in the State.

GENERAL DESCRIPTION.

Miscellaneous Items.

Formation. — Webster County was formed from portions of Nicholas, Braxton, and Randolph as recorded in Chapter 47 of the Acts of the Virginia General Assembly of the session of 1859-60, as quoted from Prof. W. C. Dodrill, of Webster Springs[4]:

"An Act for forming a New County out of parts of Nicholas, Braxton and Randolph.

"Passed January 10, 1860.

"1. Be it enacted by the General Assembly, that so much of the counties of Nicholas, Braxton and Randolph as is contained within the following boundary line, to-wit:

"Beginning at the main forks of the Little Kanawha river, above Haymond's mills; thence north with the right hand fork of said river, being the original line of Lewis and Braxton counties, and now the line between Upshur and Braxton counties, at the head of said right hand fork of Kanawha; thence a straight line to the eastern corner of the lands of Abraham Buckhannon; thence a

[3]First Annual Report, State Road Bureau, p. 306; 1914.

[4]Wm. C. Dodrill, Moccasin Tracks and other Imprints, pp. 90-91; Lovett Printing Company, Charleston, W. Va.; 1915.

straight line to the Whittaker rock on Elk river; thence a straight line, by way of the Three forks of Gauley river, to the Pocahontas line, and with said line to a point opposite the mouth of Stroud's Creek, thence a straight line by the mouth of Stroud's creek, to the mouth of Skiles' creek on Big Birch River; thence a straight line to the half way point on Holly River; thence a straight line to the beginning—be and the same is hereby established as a new county; which shall be known by the name of Webster.

"2. The court house or seat of justice of said county of Webster shall be located on the farm of Addison McLaughlin at the Fork Lick on Elk river, between the said river and the Back fork of same; which said seat of justice shall be known by the name of Addison."

A subsequent change in the county boundaries is described as follows by Dodrill[5]:

"Because of certain peculiar conditions existing in the line dividing Greenbrier and Nicholas counties, the line of the new county could not be made to conform with the act of 1860 without annexing a part of Greenbrier county, which the act forming Webster County did not authorize. This defect was cured by an act of the West Virginia legislature in 1882 by annexing about thirty square miles of territory under the jurisdiction of Greenbrier and Nicholas Counties to Webster county. This line, surveyed by Bernard Mollohan, assisted by James Woodzell and Isaac W. Cool, began at the mouth of Stroud's creek and extended to near the head of Bannock Shoal run, on the divide between the Gauley and the Williams rivers. At the time of the passage of this act Webster county was represented in the legislature by Charles McDodrill, who was instrumental in securing its enactment."

Many other items of interest concerning the formation and early history of Webster are contained in the publication mentioned above, to which the reader is referred for further data.

Area. — The area of Webster by Magisterial Districts, as determined with planimeter by R. C. Tucker, from the topographic sheets of the United States Geological Survey, is as follows:

Districts.	Square Miles.
Hacker Valley	80.94
Holly	101.92
Fork Lick	153.50
Glade	222.24
Total for county	558.60

[5]Ibid., p. 98; 1915.

The area of that portion of Mingo District, Randolph County, included in this Report, comprises 34.64 square miles, as determined by Miss Buchanan by the same method.

Relief. — The surface of Webster varies in elevation from 940 feet above sea-level at the point where the Webster-Braxton line crosses Elk River one mile east of Centralia, to 4200 feet near the corner of Webster, Greenbrier, and Pocahontas, just south of Dogway village on a branch of Cranberry River, making a total variation of 3260 feet.

Climate. — The climate of northern Webster differs but little from that found in other central counties of the State but that portion embraced in the high plateau lands south of Elk River differs to a considerable extent, the summer season being perceptibly shorter and the winters more severe. The following statistics, furnished by H. C. Howe, Section Director, U. S. Weather Bureau, Parkersburg, W. Va., give the main climatological facts:

Mean Temperatures—Webster Springs, W. Va.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1902	.....	.....	.....	52.6	.....	.....	73.9	71.7	66.2	57.4	50.1	.....	.....
1903	33.2	.....	54.6	52.8	64.0	.....	71.8	71.5	.....	54.6	37.7	26.2	.....
1904	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1905	.....	.....	.....	.....	66.1	.....	.....	.....	.....	.....	.....	.....	.....
1906	40.6	34.0	38.6	55.6	62.8	.....	.....	.....	.....	.....	.....	.....	.....
1907	.....	34.4	.....	.....	.....	.....	.....	70.4	67.4	51.7	42.8	36.2	.....
1908	30.8	31.8	50.2	56.2	64.2	69.6	.....	.....	.....	.....	.....	.....	.....
1909	.....	41.8	40.0	53.2	60.6	72.0	70.4	71.8	64.0	50.4	50.4	28.7	.....
1910	34.6	34.0	50.4	53.8	58.0	65.8	73.2	70.8	69.0	64.8	.....	.....	.....
1911	.....	.....	.....	53.8	65.2	69.6	71.6	74.6	69.6	58.2	.....	.....	.....
1912	.....	.....	.....	.....	62.8	67.5	72.2	69.4	69.0	56.4	46.8	.....	.....
1913	.....	.....	.....	51.9	61.2	58.2	72.8	71.0	62.6	.....	.....	.....	.....
1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1915	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1916	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1917	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	34.8	35.2	46.8	53.7	62.8	67.1	72.3	71.4	66.8	56.2	45.6	30.4	.....

Precipitation—Webster Springs, W. Va.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1902	3.40	4.60	5.90	.....	.....	.....	2.80	1.80	2.50	3.50	3.00	.....	.....
1903	3.00	.....	2.02	3.75	3.50	.....	.....	.....	.....	0.80	.....	1.20	.....
1904	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1905	.....	.....	.....	.....	5.20	.....	.....	.....	.....	.....	.....	.....	.....
1906	5.70	1.60	6.90	3.50	3.30	.....	.....	.....	.....	.....	.....	.....	.....
1907	.....	2.20	.....	.....	.....	.....	.....	6.69	4.92	5.12	5.42	3.82	.....
1908	5.30	4.83	6.96	5.07	7.24	3.91	.....	.....	.....	.....	.....	.....	.....
1909	.....	.....	1.60	7.90	3.80	9.15	2.33	1.93	3.65	1.79	2.70	3.59	.....
1910	5.66	3.57	1.33	4.40	5.73	8.58	4.62	2.87	5.67	.....	.....	.....	.....
1911	.....	.....	.....	.....	2.00	6.22	3.61	4.39	6.06	6.31	.....	.....	.....
1912	.....	.....	.....	.....	5.59	5.04	12.89	4.75	3.49	2.15	2.10	.....	.....
1913	.....	.....	.....	4.81	5.33	4.58	5.69	5.70	6.38	.....	.....	.....	.....
1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1915	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1916	.....	.....	.....	.....	2.62	7.02	2.87	6.01	3.60	1.84	1.61	5.74	.....
1917	5.74	4.78	13.55	3.47	8.45	6.18	7.03	1.32	1.74	1.18	2.40	1.36	.....
Means	4.80	3.60	5.47	4.70	4.79	6.34	5.23	3.94	4.22	2.84	2.87	3.14	51.94

Clear, Partly Cloudy, Cloudy, and Rainy Days—
Webster Springs, W. Va.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902	7 5 7 19	3 5 8 20	6 9 8 16	1 14 15	.. ..	.. ..	4 22 7 5	6 21 9 ..	7 15 9 8	8 17 6 6	7 11 6 12	.. ..
1903	4 6 7 20	.. ..	.. .. 6 ..	16 0 .. 14	28 0 7 3	.. ..	23 2 6	.. ..	.. ..	24 0 2 7	14 0 .. 16	18 0 8 13
1904	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
1905	.. ..	.. ..	.. ..	8 13 7 10	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
1906	2 20 10 9	6 15 9 7	1 12 17 18	9 14 12 7	6 22 8 3	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. .. ..
1907	.. ..	3 0 10 25	.. ..	.. ..	.. ..	.. ..	.. ..	17 10 11 4	19 7 15 4	19 8 10 4	15 7 12 8	16 3 18 12
1908	13 9 17 9	12 8 15 9	13 7 16 11	17 6 14 7	11 12 21 8	21 6 11 3	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
1909	.. ..	.. ..	7 12 12 12	9 14 13 7	9 16 6 6	8 12 17 10	8 18 9 5	10 14 7 7	11 17 4 2	14 11 7 6	14 11 7 5	4 12 14 15
1910	5 8 12 18	5 12 13 11	12 16 6 3	.. ..	9 10 13 12	5 14 18 11	6 17 12 8	8 20 8 3	5 17 12 8	.. ..	.. ..	.. ..
1911	.. ..	.. ..	.. ..	.. ..	11 15 4 5	8 12 13 10	6 20 10 5	8 16 14 7	7 15 15 8	8 7 11 16	.. ..	.. ..
1912	.. ..	.. ..	.. ..	.. ..	14 4 13 13	7 14 10 9	8 11 19 12	8 14 12 9	11 10 10 9	16 10 4 5	.. ..	.. ..
1913	.. ..	.. ..	.. ..	11 8 13 11	11 10 10 10	14 12 11 4	11 18 11 2	16 7 8 8	7 13 12 10	.. ..	.. ..	.. ..
1914	Report Missing											

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1915	Report Missing											
1916	.. .. ..	.. .. ..	.. .. ..	.. .. ..	 6	 9	 12	 12	16 4 4 10	20 1 5 10	7 0 4 23	16 0 10 15
1917	11 0 8 20	6 0 7 22	5 0 11 26	16 0 9 14	7 3 9 21	17 0 7 13	17 8 8 6	25 0 4 6	17 3 5 10	16 0 5 15	18 3 5 9	.. .. 7 ..
Average	7 8 10 16	5 7 9 16	8 9 11 14	11 8 12 11	12 10 9 9	11 10 11 9	11 14 10 6	12 13 10 6	11 11 9 8	15 7 6 9	13 5 7 12	13 5 11 13

First figures indicate clear, partly cloudy, and cloudy days; second, rainy days.

Population. — The following table, taken from the U. S. Census returns for 1910, shows the population of Webster for the last three enumerations:

Population of Webster County.

Minor Civil Division.	1910	1900	1890
Fork Lick District, including Addison town	2,397	1,856	1,416
Addison town (Webster Springs P. O.)	500	297	.....
Glade District including Camden-on-Gauley and Cowen towns	3,991	3,874	1,460
Camden-on-Gauley town (incorporated in 1904)	263	.....	.....
Cowen town	312	257	.....
Hacker Valley District	1,490	1,588	1,094
Holly District	1,802	1,544	813
Totals for county	9,680	8,862	4,783

The returns show an abnormal increase during the period between 1890 and 1900, due to the railroad development and consequent influx of population that took place at that time.

Products. — The principal animal products are horses, cattle. poultry, sheep, and hogs, their value being in the order named.

The principal agricultural products are corn, apples, hay, Irish potatoes, peaches, oats, buckwheat, and wheat.

The principal mineral and manufactured products are lumber, coal, chemical wastewood products, and mineral waters.

Property Valuation. — According to Hon. J. S. Darst, State Auditor, the following table shows the property valuation of Webster for the last three assessments:

	1915	1916	1917
Real Estate	$5,831,257	$6,006,955	$6,325,450
Personal Property	1,517,285	1,506,672	1,706,035
Totals	$7,348,542	$7,513,627	$8,031,485

According to P. J. McGuire, Clerk of the County Court of Webster County, the assessed valuation of Webster for the year 1918 is as follows:

Real Estate	$6,308,880
Personal Property	1,956,705
Public Service Corporations	1,102,629
Grand Total	$9,368,214

Postal Service. — Webster County is served partly by the railway mail service and partly by star route carriers. There are no rural free delivery routes. The following table compiled from information furnished by George Jackson, Postmaster of Webster Springs, shows the number of post-offices now in existence in the county:

Webster County Post-Offices.

Arcola
Bergoo
Bernardstown
Boggs
Bolair
Camden-on-Gauley
Cleveland
Cowen
Diana
Dyer
Erbacon
Gauley Mills
Hacker Valley
Kovan
Marcus
Orndoff
Poling
Prestonia
Ralph
Removal
Replete
Samp
Skelt
Skyles
Strouds
Upper Glade
Wainville
Waneta
Webster Springs
Wheeler
Woodzell

Towns and Industries.

Webster Springs.

Webster Springs is the county-seat of Webster and the largest town. It was established as the town of Addison by act of the Virginia General Assembly, January 10, 1860, the name being changed to Webster Springs in 1903. Its population by the census of 1910 was recorded as 500. The following interesting account of its early history is given by Dodrill[6].

"The Act by the Virginia General Assembly creating Webster County located the seat of Justice on land owned by Addison McLaughlin, at the junction of the Elk and the Back Fork Rivers, and declared that it should be called Addison. The place had been known as Fork Lick for many years. When the town was surveyed it was called by the latter name and it continued to be so until an Act was passed by the Legislature of West Virginia in 1873 declaring that the town thereafter should be known as Addison. The name was changed in 1903 to Webster Springs by legislative enactment.

"The commissioners, Samuel Given, Thomas Cogar, William Arthur, Thomas Reynolds and William Given, who were named in the act providing for the formation of Webster county to select a site for a court house, jail and other public buildings, and to divide the county into three magisterial districts, proceeded to the discharge of the duties imposed upon them. The commissioners selected and staked a lot two hundred and ten feet square on the hill above the Salt Sulphur spring as a site for the court house and jail. This lot is now the public square of Webster County. Henry C. Moore surveyed the lot after its selection by the commissioners. The town of Addison was also surveyed and divided into lots by him at about the same time."

The town of Webster Springs owes its existence primarily to the county business, as described above, besides being the natural distributing point for a considerable portion of the Elk, Gauley, and Holly River Valleys. It is a noted summer resort, in addition, having the well-known Salt Sulphur and other mineral and healing springs, which will be later described, the influx of summer visitors being cared for by numerous hotels, chief among which are the Webster Springs and the Oakland, which cater only to the summer

[6]Ibid., pp. 98 and 156; 1915.

trade. Situated at the junction of Elk and Back Fork Rivers the town is favored by a setting of wondrous natural beauty, the mountains on either side of Elk rising to precipitous heights, 1500 to 1700 feet above the narrow valley, while Point Mountain fills the space between the two rivers and completes the harmonious ensemble. The coal development of the two valleys, probably near at hand, must look to Webster Springs as its logical center, and it will build an industrial community of which the present town is only a modest nucleus, but, if properly planned, this new industry need not destroy nor becloud the natural picturesque beauty that every visitor thoroughly enjoys.

No manufacturing concerns are located at Webster Springs or within its immediate vicinity. Its transportation needs are served by the West Virginia Midland Railroad, affording freight and daily passenger service.

Cowen.

Cowen, ranking second in point of size in the county, and having a population of 312, according to the census returns of 1910, is located near the western edge of Glade District and on a high divide between Laurel Creek of Elk, Big Ditch Run of Gauley, and the head of Birch River. In sharp contrast to the major portion of the county, it is surrounded by low hills and wide glady valleys, making this particular region the chief agricultural belt of the county, although early frosts are the rule. Its transportation needs are served by the Richwood Branch of the Baltimore and Ohio Railroad, which crosses the gap at an elevation of 2248 feet above sea-level, this being the highest point along the line between Clarksburg and Richwood. According to J. F. Smith, Cowen was incorporated as a town in the year 1898. Its existence depends chiefly on the good farming community that surrounds it, there being no manufacturing enterprises, but it is a shipping point for rough lumber and cross-ties cut by portable sawmills in the neighborhood.

Camden-on-Gauley.

Camden-on-Gauley, located on the Gauley River near the

extreme southwestern edge of the county, was incorporated as a town in 1904, its population in 1910 being 263. It was formerly called Lanes Bottom but was given its present name in honor of Senator J. N. Camden, through whose efforts the Richwood Branch of the Baltimore and Ohio Railroad was built in 1892. Its business is partly due to the railroad which maintains extensive yards, partly to the lumber and wood industries near it, and finally as a supply point for a considerable portion of western Webster and eastern Nicholas Counties.

Gauley Mills.

Gauley Mills is an unincorporated town with a population estimated at 250, located on the Gauley River one mile east of Camden-on-Gauley, deriving its name from the large mill to which it owes its existence. Although closely adjoining the corporate limits of Camden-on-Gauley it maintains a separate post-office and railroad station on the Richwood Branch of the Baltimore and Ohio.

Cherry River Boom and Lumber Company, Gauley Mills.—The Gauley Mill of the Cherry River Boom and Lumber Company, located in Gauley Mills, is a large plant devoted to the manufacture of hardwood lumber. It was established by the Baltimore and Ohio Railroad in 1889 or 1890, a year or more before the railroad was completed through Gauley Mills, the heavy machinery having been hauled by wagon forty or fifty miles from the Chesapeake and Ohio Railway in the Greenbrier Valley. The mill was acquired by the Cherry River Boom and Lumber Company in 1905, according to H. W. Armstrong, General Superintendent, its activities being mainly directed from the Richwood office although headquarters are maintained in Philadelphia, Pa. According to C. P. Hanrahan, Chief Inspector, the mill has a double band and resaw equipment, its daily capacity being 82,000 feet, 160 men being employed with an average monthly payroll of $8,000. The same company maintains two other large mills, located at Richwood and Holcomb, both in Nicholas County, and timber for the three plants comes mainly from

PLATE II.—Webster Springs Sandstone at "Lover's Leap," southeast edge of Webster Springs town; Elk River in foregroud.

the head of Cranberry River in Webster and Pocahontas, although vast reserves are owned by the company on Gauley and Williams Rivers.

West Virginia Waste Wood Chemical Company. — The West Virginia Waste Wood Chemical Company, located at Gauley Mills in the vicinity of the lumber mill above described, was established in 1916, its head office being at 17 Battery Place, New York City. According to S. E. Seaman, Vice-President, the plant is designed to manufacture acetone, refined methyl alcohol, methyl acetone, acetone oil, flotation oils, pitch, charcoal briquettes, and a number of solvent oils, its raw material being the sawdust, slabs, bark, and other refuse from the Gauley Mill of the Cherry River Company, its capacity being 150 tons of wood. The plant employs 60 men of whom 50 are skilled laborers, the average monthly pay-roll being $7,500. The main feature of its mechanical equipment is the Seaman Distillation Process, designed especially for the concern by the Vice-President, and perfected in a small experimental plant built at Gauley Mills prior to the establishment of the main factory.

Villages.

Besides the large towns described above there are many small villages scattered throughout the county, of which the following list gives the principal ones, with their populations, some of which are by actual count made in the presence of the writer:

Webster County Villages.

Village.	Population 1916.	Village.	Population 1916.
Arcola	75 (E)	Prestonia	50 (E)
Cleveland	50 (E)	Removal	60 (E)
Diana	125 (E)	Skyles	200 (E)
Erbacon	194 (C)	Wainville	70 (E)
Hacker Valley	106 (C)		

C—Actual Count by Postmaster or other responsible person in 1916.

E—Estimate by Postmaster or other responsible person in 1916.

CHAPTER II.

PHYSIOGRAPHY.

PHYSIOGRAPHIC CHANGES.

Geographically Webster County belongs in the Cumberland Plateau, or western division, of the Appalachian Province. Its surface features are a continuation of land forms that occur and have been described in counties lying farther north and west, the mountains and ridges that form the present sky-line being the remains of an extensive peneplain developed in early Cretaceous time when practically the whole surface of the Cumberland Plateau was reduced to an almost level condition. Subsequent elevation of the general surface has raised this old peneplain to a much higher level than it formerly occupied, and consequent stream erosion, much of which was in progress during the epoch of elevation, has cut great valleys through the ancient plain until the sky-line alone, as formed by the ridges, is left as a reminder of this age long past. As the total elevation along the southeastern border of the plateau, next to the Alleghany Front, was much greater than in the region next to the Ohio River a cross-section of the sky-line shows a gradual northwestward dip.

Certain features still remain that indicate a still more ancient land surface than that described above. Along the crest of Turkeybone Mountain in western Randolph and eastern Webster, several sharp peaks rise to a height of one hundred or more feet above the general surface, among which Bee Knob and Pisgah Knob are conspicuous. On Point Mountain, farther west, Potato Knob is another prominent instance, all three being capped by the hard and durable Homewood Sandstone member of the Pottsville Series. Farther northwest the Hodam Mountain seems to be another

fragment of a land surface that existed in pre-Cretaceous time.

In the Alleghany Mountain region farther east there is a well-marked peneplain that developed subsequent to that of the Cretaceous period described above. This latter epoch of leveling probably reached its maximum development in early Tertiary time but in Webster never reached a mature stage. Its influence can be noted in many of the short tributary ravines that flow into the Elk, Gauley, and Williams Rivers, the drainage basins of these rivulets showing an approach to base-leveled maturity near their heads but plunging abruptly down for several hundred feet in the last quarter or half mile of their courses. Some of these steep descents may be accounted for by hard sandstone ledges that hold up the valleys but most of them are evidently due to the Tertiary uplift that revived the parent streams and caused rapid cutting that has not yet reached the heads of the tributaries. On the waters of Holly River north of Elk these features are not so noticeable, the inference being that the uplift was less pronounced in the regions farthest from the Alleghanies.

It is possible that the Cowen glades are partly due to the Tertiary peneplain, but while this may have been their primary cause it is quite certain that they have been preserved from erosion by the ponding effect of the Gilbert, Dotson, and other heavy sandstones which emerge from drainage on the southeastward rise of the rocks and form dams which hold the higher sediments securely.

Evidence of a former base-leveled condition of many of the larger streams is abundant. Both the Elk and Gauley show numerous meanders that must have developed during the time of the Cretaceous Peneplain and which have been preserved through all the subsequent cutting that has reduced their valleys to a much lower level. The Little Kanawha, Holly, and Cranberry Rivers show the same features but at much less frequent intervals.

The rapid erosion now going on in many of the larger streams and the absence of wide valleys and recent meanders indicate that the present physiographic cycle is an interme-

diate phase and that well nigh countless years must elapse before the great intervening ridges can be reduced to another peneplain.

There is no evidence to show that the minor folds that cross Webster have influenced the course of any important streams. The Elk, Gauley, Williams, and Cranberry Rivers all cut across both the Webster Springs Anticline and the Kovan Syncline without any perceptible deflection of their directions, the slow nature of the folding, that allowed erosion to continue steadily, being very apparent.

Only a few instances of diverted stream channels and stream capture may be noted. On the Left Fork of Holly River, three miles east of Hacker Valley, the river may have once flowed through an old channel north of Potato Knob. It is possible, however, that Fall Run may have gone through this channel before being diverted to its present location. On Elk River, one-half mile southeast of Ralph and about the same distance west of the mouth of Mill Run, there is a very low divide showing rounded boulders and other evidence of river deposits indicating that the Elk may have once used this divide as a channel before being diverted to its present course north of the round knob near Ralph.

An apparent instance of stream capture may be noticed at the head of Birch River just northwest of Cowen, where the direction of the tributary streams indicates clearly that Left Fork of Big Ditch Run once had its head near the elbow turn of the river four miles north of Cowen, approximately three miles of its drainage having been lost through the predatory action of Birch River. In the same region the Right Fork of Big Ditch Run has suffered also, as its source seems once to have been coincident with a small stream heading one-half mile west of Marcus and now flowing into Laurel Creek.

DRAINAGE BASINS.

The following table, prepared by Miss Buchanan, gives a list of the principal streams of Webster, their lengths being divided into sections, usually between large tributaries, and the rate of fall and length, both actual stream measurement

and air-line distances, being determined. The last column shows the ratio between the total distance (T. D.) and the air-line distance (A. L. D.). Those having the greatest ratio are usually streams that have more nearly reached base-level:

Table of Stream Data.

STREAMS.	Total Distance Miles	Total Fall Feet	Rate of Fall Per Mile. Feet	Air-Line Distance Miles	Ratio of T. D. to A. L. D.
Right Fork, Little Kanawha River, Rock Camp Run to Cleveland	5.2	660	126.9	3.7	1.41
Right Fork, Little Kanawha River, Cleveland to Wildcat	4.9	335	68.36	3.5	1.40
Left Fork, Holly River, Bee Run to Hacker Valley	5.5	525	95.4	5.0	1.10
Left Fork, Holly River, Hacker Valley to Poling	6.6	290	43.9	4.0	1.65
Left Fork, Holly River, Poling to forks of Holly	7.1	260	36.6	5.9	1.20
Fall Run, Straight Fork to mouth	3.5	635	181.4	3.4	1.03
Laurel Fork, Middle Fork to mouth	5.6	745	133.04	4.1	1.36
Hodam Creek, Hodam to mouth	2.3	135	58.69	2.2	1.05
Oldlick Creek, Cougar Fork to mouth	6.4	535	83.59	5.5	1.16
Right Fork, Holly River, Laurel Fork to Grassy Creek	5.6	545	97.32	4.7	1.19
Right Fork, Holly River, Grassy Creek to Removal	5.7	200	35.08	4.8	1.19
Right Fork, Holly River, Removal to forks of Holly	7.4	145	19.59	5	1.48
Desert Fork, Amos Fork to mouth	5.5	535	97.27	4.6	1.19
Grassy Creek, Kovan to Little Grassy Creek	5	315	63	4.1	1.22
Grassy Creek, Little Grassy Creek to mouth	4.7	525	111.7	3.4	1.38
Elk River, Big Spring Fork to Valley Fork	9.6	455	47.39	8	1.2
Elk River, Valley Fork to Bergoo village	11.2	470	41.96	9	1.24
Elk River, Bergoo village to Webster Springs	10.5	360	34.28	6.4	1.64
Elk River, Webster Springs to Centralia	22.8	510	22.37	12.5	1.82
Valley Fork, Mudlick Run to mouth	2	290	145	1.9	1.01

Table of Stream Data (Continued).

STREAMS	Total Distance Miles	Total Fall Feet	Rate of Fall Per Mile. Feet	Air-Line Distance Miles	Ratio of T. D. to A. L. D.
Bergoo Creek, Webster-Randolph line to mouth	4.7	950	202.12	4.4	1.07
Leatherwood Creek, forks to mouth	3.1	340	109.67	2.8	1.11
Back Fork, Vandevender Fork to Sugar Creek	11.5	980	85.17	9.5	1.21
Back Fork, Sugar Creek to mouth	10	455	45.5	7.5	1.67
Sugar Creek, Anderson Camp Run to mouth	8.1	700	86.42	6.9	1.17
Little Sugar Creek, Holly-Hacker Valley District Line to mouth	4.5	465	103.33	3.4	1.32
Laurel Creek, Denison Run to Erbacon	8.6	615	71.51	6	1.43
Laurel Creek, Erbacon to Centralia	8.3	580	69.88	6.8	1.22
Camp Creek, Upper Laurel Fork to mouth	5.5	670	121.81	4.6	1.19
Gauley River, South Fork to Straight Creek	4.2	355	84.52	2.7	1.55
Gauley River, Straight Creek to Turkey Creek	4.9	195	39.79	4	1.22
Gauley River, Turkey Creek to Bolair	7	50	7.14	4.7	1.49
Gauley River, Bolair to Williams River	6.3	110	17.46	5.3	1.89
Gauley River, Williams River to Allingdale	10.4	170	16.34	5.6	1.85
Gauley River, Allingdale to Cranberry	6.9	85	12.32	4	1.72
Big Ditch Run, Welch Glade to mouth	3.2	115	35.94	2.6	1.23
Big Laurel Creek, Coe to mouth	2.5	440	176	2.4	1.04
Coon Creek, Locust Grove School to mouth	1.3	65	50	1.2	1.08
Strouds Creek, Mud Fork to mouth	4.4	110	25	3.8	1.16
Williams River, Bannock Shoals Run to Three Forks	8.1	453	55.92	6.4	1.26
Williams River, Three Forks to mouth	9.5	192	20.21	8.1	1.17
Middle Fork, McClintock Run to Beechy	4.4	685	155.68	3.4	1.29
Middle Fork, Beechy to mouth	2.8	238	85	2.5	1.12
Little Fork, most southern forks to mouth	2.4	694	289.16	2.2	1.09

Table of Stream Data (Continued).

STREAMS	Total Distance Miles	Toial Fall Feet	Rate of Fall Per Mile. Feet	Air-Lide Distance Miles	Ratio of T. D. to A. L. D;
Cranberry River, North Fork to Dogway Fork	4.6	255	55.43	3.1	1.48
Cranberry River, Dogway Fork to Aldrich Branch	8.9	470	52.81	7.4	1.20
Cranberry River, Aldrich Branch to mouth	10	520	52	8.1	1.23
Birch River, Back Fork to Barnet Run	7	512	73.14	4.4	1.59
Birch River, Barnet Run to Skyles	3.4	293	86.17	3.2	1.06

The following table, prepared by Miss Buchanan gives a planimetric determination of the areas of the different drainage basins of Webster, the Topographic Sheets of the United States Geological Survey and the West Virginia Geological Survey being used for authority:

Areas of Drainage Basins.

Stream	Square Miles
Right Fork, Little Kanawha River, head to Wildcat	37.50
Holly River, entire, with all branches	147.68
Left Fork, Holly River, entire	77.88
Fall Run	6.42
Laurel Fork	11.32
Hodam Creek	9.07
Long Run	3.34
Oldlick Creek	11.72
Right Fork, Holly River, entire	62.56
Desert Fork	9.63
Grassy Creek	19.87
Elk River, above mouth of Holly	284.17
Elk River, above Webster Springs	169.87
Elk River, above Valley Fork	86.68
Valley Fork	7.95
Bergoo Creek	12.79
Leatherwood Creek	17.76
Mill Run	3.48
Back Fork of Elk, entire	47.75
Back Fork of Elk, above Sugar Creek	32.59
Sugar Creek, entire	23.29
Sugar Creek, above Little Sugar Creek	13.93
Little Sugar Creek	7.09

Areas of Drainage Basins—(Continued).

Stream	Square Miles
Houston Run	4.72
Laurel Creek, entire	66.96
McAvoy Run	4.15
Amos Run	7.53
Missouri Creek	5.02
Brooks Creek	4.48
Camp Creek	9.43
Gauley River, entire	1350.37
Gauley River, above and including Cranberry River	261.27
Gauley River, above but not including Cranberry River	187.19
Gauley River, above but not including Williams River	76.99
Straight Creek	3.80
Turkey Creek	10.60
Miller Mill Run	4.75
Big Ditch Run	9.16
Big Laurel Creek	5.52
Coon Creek	1.89
Strouds Creek	8.45
Williams River	130.63
Middle Fork	27.17
Little Fork	4.11
Cranberry River	74.08
Dogway Fork	10.28
Birch River, entire	140.60
Birch River, above and including Skyles Creek	26.60
Skyles Creek	7.18

DESCRIPTION OF DRAINAGE BASINS.

Right Fork of Little Kanawha River.

Right Fork of Little Kanawha River, draining a portion of northern Webster, rises at the common corner of Webster, Upshur, and Randolph, at an elevation of 2765 feet, flows northwestward 12 miles to the Little Kanawha at Wildcat, where its elevation is 940 feet, making a total fall of 1825 feet. The area of its drainage basin is 37.5 square miles. Most of the territory through which it flows is wooded, and the flow is therefore more constant than along the main river farther down. For most of its length it is a rapid, shallow stream. Its waters reach the Ohio River at Parkersburg.

Holly River.

Main Holly River is formed by the junction of two branches of nearly equal length and drainage area, that unite at Holly, Braxton County, each of these tributaries being described in detail below. From their junction the course of the main stream is westward, with frequent meanders, to Palmer, where it flows into Elk River. At the forks of Holly the elevation is 940 feet, and at Palmer it is 900 feet, making a fall of 40 feet, and as the total distance is 3.8 miles the rate of fall per mile is 10 feet. The total area of the Holly drainage basin is 147.68 square miles. It is more nearly base-leveled than any other large stream in the county, frequently having wide bottoms and its current being usually placid. Such meanders as it has do not belong to the present cycle but have been inherited from the time of the Cretaceous peneplain. Owing to the extremely steep topography on either side it is subject to heavy floods.

Left Fork of Holly River, rising in Randolph two miles southwest of Pickens, the elevation at its source being 3450 feet, flows generally westward, entirely across Webster, and joins with the Right Fork to form main Holly River at Holly, where the elevation is 940 feet, thus making the total fall 2510 feet, most of which is in its upper course above Hacker Valley. The area of its drainage basin is 77.88 square miles. Below Hacker Valley there are occasional meanders inherited from the time of the Cretaceous Peneplain, but the valley at certain places is wide, indicating a rather mature cycle of development although there are no recent meanders. The steep nature of its topography makes it subject to frequent floods. Starting at its head the principal tributaries are Fall Run, Laurel Fork, Hodam Creek, Long Run, and Oldlick Creek, the areas of whose drainage basins are given in the table, page 23.

Right Fork of Holly River rises in Webster one mile northwest of Skelt, flows westward for the first seven miles of its course when it veers sharply to the northwest, and, with the exception of local meanders, preserves this general direction until it meets the Left Fork at Holly, its total

length from head to mouth being 20.4 miles. The elevation of its source is 3100 feet and of its mouth 940 feet making a total difference of 2160 feet. Above Diana it is a swift and turbulent stream but throughout the remainder of its course there is only a moderate current, there being frequent wide valleys but no recent meanders, those that exist being clearly due to the Cretaceous Peneplain of former times. The slopes along either side are extremely steep, making floods of frequent occurrence. Starting at its head the principal tributaries are Laurel Fork, Desert Fork, Big Run, Grassy Creek, Lower Big Run, and Bear Run. The area of its drainage basin including tributaries is 62.56 square miles.

Elk River.

Elk River, the principal drainage basin in Webster, heads at Spruce Knob in Pocahontas County, 7½ miles northwest of Marlinton, at an elevation of 4730 feet. From its source it flows northward for fifteen miles through northern Pocahontas and across the southern extension of Randolph, but near the Randolph-Webster line veers sharply to a course slightly south of west and holds this general direction to a point four miles west of Webster Springs when it turns toward the northwest and so continues until it crosses the Webster-Braxton line just above Centralia. From this point its course is mainly west as far as Sutton when it turns again to the southwest and finally reaches the Great Kanawha at Charleston. At the Pocahontas-Randolph line its elevation is approximately 2400 feet, at the Whitaker Falls where it enters Webster it is 2165 feet (2150 feet below the Falls), at Webster Springs it is 1440 feet and at Centralia it is 925 feet. At Charleston it has descended to 565 feet. Its entire length from Spruce Knob to Charleston, including meanders, is 172 miles, that portion of it in Randolph being 7.4 miles, and that in Webster 42 miles. In these counties it is mainly a swift, shallow stream, there being occasional deep pools caused by the scouring of soft sediments at the base of the numerous low cataracts that are characteristic of its course above Webster Springs. In Pocahontas, Randolph, and Web-

ster its course is between very steep mountain walls, varying from 1000 to 2000 feet in height, and making a run-off that is severe during rainy weather, but retarded somewhat by the generally wooded condition of the slopes. There are numerous wide meanders plainly inherited from the time of the Cretaceous Peneplain. Its present valley is usually narrow, there being occasional stretches of wide bottom, but no meanders of recent time. Its water is normally clear but after heavy rains the color is red owing to the great area of red Mauch Chunk shales outcropping along its course above Webster Springs. A striking peculiarity of its flow through Webster is the absence of tributaries between Webster Springs and Centralia, a distance of 22.8 miles, there being only short lateral branches. Through a considerable portion of this distance the river is practically parallel to Grassy Creek and Holly River, its horizontal distance from Grassy Creek at Summit being only 0.6 mile and from Holly River at Big Run 0.7 mile. The area of its drainage basin above Holly River is 284.17 square miles, above Webster Springs 169.87 square miles and above Valley Fork 86.68 square miles. Its principal tributaries through Randolph and Webster in descending order are Valley Fork, Bergoo Creek, Leatherwood Creek, Back Fork, and Houston Run and Laurel Creek, the latter two emptying just across the Braxton line.

Back Fork of Elk River rises in Randolph near the Whitman Knob, at an elevation of about 3700 feet, flows southwestward into Webster and empties into Elk at Webster Springs. Its elevation at the Randolph-Webster line is 2525 feet, and at Webster Springs 1440 feet, making a total fall of 2260 feet. Its length from head to mouth is 25.1 miles and the area of its drainage basin 47.75 square miles, its principal tributary being Sugar Creek which rises in Randolph against Turkeybone Mountain, 4 miles southeast of Pickens, at an elevation of 3600 feet, flows southwestward through Randolph in Webster and empties into Back Fork at Skelt, where its elevation is 1900 feet, its principal tributary being Little Sugar Creek.

Laurel Creek of Elk River rises in the Cowen glades of Webster where the surrounding hills have an elevation of approximately 2500 feet above sea-level, flows northward, entering Braxton at Prestonia and empties into Elk at Centralia, its total length being 19 miles. At Centralia its elevation is 925 feet, making a total fall of 1575 feet. The area of its drainage basin is 66.96 square miles, and its principal tributaries are Denison Run, Given Run, McAvoy Run, Road Fork, Glade Run, Amos Run, Missouri Creek, Brooks Creek, Lick Run, and Camp Creek.

From July 1, 1908, to September 30, 1916, the U. S. Geological Survey and the State Survey in conjunction have kept a gaging station on Elk River at Webster Springs, the records of which are published below, as taken from Water-Supply Papers Nos. 243, 263, 283, 303, 323, 353, 383, 403 and 433 of the U. S. Geological Survey, the following being taken from No. 243, pages 88-89:

"Elk River at Webster Springs, W. Va.

"This station is located at the suspension bridge on the grounds of the Webster Springs Hotel at Webster Springs, W. Va. It was established July 1, 1908, to obtain data for use in studying water-supply, water-power, flood control, and storage problems.

"The gage datum has remained unchanged. The records are reliable and accurate. Sufficient data have not yet been collected to enable estimates of the flow to be made.

"The following discharge measurement was made July 27, 1908:

"Width, 116 feet; area, 795 square feet; gage height, 3.90 feet; discharge, 1,230 second-feet."

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for 1908.

[Observer, Cherry Woodzell.]

Day	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.94	2.45	1.76	1.61	1.78	1.53
2	2.56	2.30	1.74	1.54	1.69	1.60
3	2.06	2.16	1.68	1.50	1.60	1.70
4	3.82	2.06	1.64	1.45	1.68	1.70
5	3.27	2.00	1.65	1.42	1.55	1.65
6	3.25	2.45	1.62	1.40	1.54	1.60
7	3.00	2.58	1.60	1.39	1.50	1.70
8	2.75	2.28	1.59	1.36	1.45	2.34
9	2.52	2.41	1.60	1.35	1.40	2.20
10	2.34	2.80	1.60	1.35	1.40	2.00
11	2.18	2.48	1.50	1.40	1.45	2.00
12	2.08	2.34	1.48	1.45	1.46	2.95
13	2.18	2.20	1.40	1.42	1.45	2.85
14	2.12	2.02	1.40	1.41	1.45	2.50
15	2.37	1.99	1.45	1.41	1.50	2.25
16	2.18	1.89	1.44	1.40	1.50	2.10
17	2.02	1.84	1.39	1.40	1.48	2.10
18	1.98	1.81	1.38	1.40	1.45	2.85
19	2.06	1.80	1.36	1.40	1.45	3.20
20	1.94	1.75	1.35	1.40	1.45	2.85
21	1.94	1.70	1.72	1.39	1.7	2.60
22	3.28	1.71	1.70	1.38	1.65	2.40
23	2.84	1.88	1.60	1.38	1.6	2.38
24	4.95	1.87	1.50	1.38	1.6	2.30
25	3.65	1.79	1.50	1.38	1.6	2.35
26	3.55	2.10	1.41	1.59	1.58	2.45
27	3.90	2.50	1.40	1.68	1.58	2.40
28	4.15	2.30	1.41	1.60	1.58	2.39
29	3.35	2.05	1.42	1.65	1.55	2.34
30	2.88	1.90	1.42	1.58	1.53	2.39
31	2.65	1.80	.....	1.78	.....	2.30

The following data are taken from Water-Supply Paper No. 263, page 95, of the U. S. Geological Survey:

Discharge Measurements of Elk River at Webster Springs, W. Va., in 1909.

Date	Hydrographer	Width Feet	Area of section Sq. Ft.	Gage height Feet	Discharge Sec.-Ft.
March 25	H. J. Jackson	123	732	3.72	957
March 25	H. J. Jackson	126	766	3.82	1,150
Nov. 26..	H. J. Jackson	125	736	3.52	830
Nov. 26..	H. J. Jackson	124	726	3.44	743
Nov. 11..	A. H. Horton	124	734	3.52	800
Nov. 11..	A. H. Horton	124	734	3.50	767

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for 1909.

[Cherry Woodzell, Observer.]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.10	.....	3.12	2.92	3.78	2.02	2.65	2.85	1.61	1.68	2.28	2.31
2	2.78	.....	3.00	3.05	3.68	2.00	2.45	2.90	1.56	1.63	2.28	2.30
3	2.60	.....	3.18	3.15	3.35	2.30	2.25	2.28	1.52	1.59	2.30	2.28
4	2.40	.....	3.38	3.28	3.25	2.25	2.08	2.14	1.58	1.56	2.26	2.25
5	3.10	2.70	3.18	3.78	3.10	2.68	2.00	2.00	1.64	1.54	2.19	2.20
6	3.68	3.02	3.15	3.85	2.95	2.49	1.99	1.96	1.68	1.52	2.15	2.20
7	3.35	3.15	3.35	3.50	2.79	2.38	2.10	1.88	1.64	1.52	2.20	2.18
8	2.95	2.95	3.90	3.20	2.78	2.22	2.00	1.86	1.60	1.50	2.12	2.20
9	2.82	2.85	3.80	2.95	2.72	2.20	1.89	1.81	1.56	1.49	2.95	2.20
10	2.70	3.85	4.40	2.82	3.12	2.30	1.82	1.74	1.58	1.48	3.80	2.20
11	2.65	3.80	3.80	2.70	3.45	2.49	1.72	1.68	1.62	1.58	3.50	2.20
12	2.65	3.32	3.40	2.70	3.15	2.35	1.72	1.62	1.68	3.55	3.15	2.20
13	2.60	3.30	3.25	2.75	2.92	2.20	2.30	1.61	1.66	2.85	2.95	2.32
14	2.70	3.75	3.55	5.60	2.72	2.25	2.40	1.60	1.60	2.35	2.72	4.20
15	4.70	3.90	3.35	4.10	2.64	2.85	2.29	1.80	1.54	2.25	2.62	3.45
16	4.10	4.25	3.12	3.58	2.54	3.29	2.18	3.14	2.24	2.50	2.45	3.18
17	3.70	3.90	2.95	3.22	2.46	2.78	2.08	2.95	2.32	2.39	2.40	2.95
18	3.35	3.55	2.80	2.95	2.40	3.05	2.00	2.55	2.05	2.35	2.39	2.55
19	3.05	3.30	2.70	2.82	2.30	2.85	2.10	1.88	1.92	2.60	2.35	2.28
20	2.92	3.95	2.68	2.75	2.25	2.65	2.00	1.72	1.79	2.59	2.29	2.25
21	2.95	3.65	2.68	3.45	2.28	2.45	1.88	1.72	1.69	2.48	2.28	2.25
22	3.00	3.85	2.88	4.30	2.90	2.30	1.75	1.62	1.63	2.38	2.25	2.25
23	2.90	3.55	2.80	4.20	2.52	2.42	1.80	1.99	1.66	2.40	2.65	2.25
24	2.90	3.45	2.80	4.05	2.44	2.70	2.72	1.92	2.70	3.25	2.85	2.25
25	2.88	3.70	3.38	3.50	2.32	2.78	2.35	1.84	2.30	3.05	2.72	2.50
26	2.82	3.40	3.52	3.30	2.30	2.55	2.15	1.79	2.05	2.88	2.62	2.52
27	2.72	3.28	3.36	3.15	2.40	2.42	1.98	1.74	1.92	2.70	2.52	2.50
28	2.60	3.20	3.75	3.70	2.34	2.29	1.96	1.70	1.84	2.62	2.42	2.50
29	2.55	.....	3.52	3.48	2.28	2.20	2.00	1.68	1.79	2.52	2.40	2.50
30	2.60	.....	3.32	3.45	2.22	2.85	3.05	1.66	1.74	2.48	2.36	2.50
31	2.50	.....	3.08	.....	2.12	.....	3.10	1.64	.....	2.38	.....	2.50

NOTE.—Ice conditions, January 20 to February 7; ice from 0.16 to 0.4 foot thick. Ice conditions December 8 to 31. Thickness of ice December 21, 0.4 foot; December 28, 0.5 foot.

The following data for 1910 are taken from Water-Supply Paper No. 283, page 85:

"The following discharge measurement was made by Bailey and Dort:

"August 13, 1910: Width, 38 feet; area, 50.4 square feet; gage height, 2.00 feet; discharge, 65.8 second-feet. The measurement was not made at the regular gaging section."

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for 1910.

[Cherry Woodzell, Observer.]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.55	2.62	4.35	2.26	2.72	2.85	2.40	2.32	1.70	2.22	2.18	2.92
2	3.65	2.60	3.95	2.24	2.62	3.55	2.32	2.15	2.50	2.12	2.24	2.82
3	5.30	2.70	3.68	2.24	2.52	3.42	2.28	2.02	2.32	2.02	2.36	2.72
4	4.45	3.00	3.45	2.27	2.48	3.30	2.75	2.40	2.50	1.94	2.34	2.62
5	3.90	2.92	3.25	2.45	2.42	3.95	3.10	2.48	2.62	1.88	2.25	2.52
6	3.45	2.82	3.20	2.50	2.34	4.75	2.88	2.30	2.74	1.80	2.18	2.60
7	5.10	2.80	3.25	2.52	2.30	4.50	2.88	2.12	2.75	1.80	2.12	2.52
8	3.85	2.72	3.08	2.54	2.24	3.40	3.09	2.02	2.62	1.88	2.14	2.50
9	3.35	2.78	2.88	2.51	2.60	3.10	2.89	1.98	2.50	2.14	2.06	2.48
10	3.28	3.00	2.70	2.49	2.62	3.50	2.75	1.92	2.48	2.28	2.02	2.40
10	3.22	2.80	2.62	2.44	2.58	3.90	2.55	1.89	2.35	2.20	2.00	2.40
12	3.12	2.80	2.60	2.45	4.15	3.90	2.38	1.82	2.22	2.05	2.00	2.36
13	2.95	2.84	2.58	3.11	3.84	3.90	3.10	2.05	2.80	1.95	2.00	2.28
14	3.05	2.80	2.55	2.98	3.30	3.92	3.00	1.93	2.78	1.86	1.98	2.18
15	2.85	2.82	2.50	2.90	3.01	3.72	2.90	1.82	2.55	1.82	2.00	2.10
16	2.68	3.20	2.45	2.75	2.90	6.34	2.82	1.74	2.35	1.77	2.00	2.25
17	2.60	4.35	2.45	2.70	2.75	5.18	2.72	1.68	2.29	1.76	2.00	2.18
18	3.30	4.75	2.40	2.90	2.72	4.00	2.60	1.66	2.15	1.74	1.97	2.25
19	4.55	3.95	2.40	3.00	2.75	4.25	2.51	1.66	1.99	1.71	1.95	2.70
20	4.10	3.65	2.40	2.98	2.66	3.72	2.46	1.70	1.98	1.70	1.94	3.00
21	4.30	3.35	2.42	3.15	2.66	3.80	2.32	1.69	1.97	1.68	1.92	3.00
22	4.20	4.05	2.50	3.28	2.80	3.80	2.22	1.68	1.92	1.90	1.90	2.90
23	3.50	3.80	2.44	3.60	2.82	3.40	2.12	1.69	1.82	2.32	1.88	2.90
24	3.25	3.45	2.40	4.08	2.70	2.98	2.25	1.79	1.78	2.18	1.98	3.60
25	2.95	3.25	2.39	3.85	2.70	2.88	2.25	1.78	1.96	2.02	2.25	3.48
26	3.32	3.05	2.36	3.52	2.80	2.72	1.92	1.72	2.54	1.99	2.70	2.85
27	2.80	2.85	2.31	3.25	2.72	2.60	2.10	1.66	2.68	2.05	2.69	3.05
28	2.98	3.20	2.30	3.08	2.62	2.88	2.45	1.64	2.55	2.42	2.82	2.25
29	2.90	.....	2.30	3.00	2.52	2.75	2.35	1.62	2.38	2.42	3.35	3.60
30	2.82	.....	2.30	2.85	2.58	2.58	2.55	1.68	2.31	2.28	3.05	5.50
31	2.72	.....	2.28	.....	2.70	.....	2.45	1.63	.....	2.20	.....	4.20

NOTE.—Relation of gage height to discharge affected by ice about Jan. 1 to 3, Feb. 8 to 16, and Dec. 11 to 26.

The following data are taken from the U. S. Geological Survey Water-Supply Paper No. 303, pages 57 and 58, for the year 1911:

"Location.—At suspension bridge on the grounds of the Webster Springs Hotel, at Webster Springs, W. Va., one-fourth mile above the mouth of Back Fork.

"Records available.—July 1, 1908, to December 31, 1911. .

"Drainage area.—168 square miles.

"Gage.—Vertical staff attached to right abutment of bridge; datum unchanged since established.

"Channel.—Coarse gravel; practically permanent.

"Discharge measurements.—Made from upstream side of bridge or by wading.

"**Point of zero flow.**—Levels taken August 13, 1910, indicate that there would be no flow past the gage at a stage of 0.95 foot ± 0.2 foot

"**Winter flow.**—Relation of gage height to discharge is sometimes affected by ice.

"**Accuracy.**—Gage-height records are considered reliable. Sufficient data have not been obtained to permit estimates of discharge to be made.

"The following discharge measurement was made by Bailey and Perwien:

"October 26, 1911: Gage height, 2.62 feet; discharge, 218 second-feet."

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for 1911.

[Cherry Woodzell, Observer.]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.10	4.00	3.00	2.92	2.60	2.04	2.06	1.57	2.65	2.60	2.30	2.98
2	5.20	3.89	2.92	2.87	2.72	1.97	1.98	1.61	2.35	3.10	2.22	2.85
3	5.20	3.55	2.78	3.05	2.62	1.86	1.92	1.59	2.10	3.50	2.16	2.72
4	4.40	3.45	2.70	3.75	2.58	1.78	1.91	1.54	1.92	3.18	2.14	2.68
5	3.75	3.20	2.65	5.15	2.50	1.95	1.88	1.50	1.82	3.30	2.11	2.58
6	3.32	3.02	4.05	4.30	2.46	2.08	1.82	1.50	1.79	2.90	2.45	2.54
7	3.05	2.92	4.25	3.90	2.42	2.06	1.88	1.80	1.76	3.60	4.25	2.50
8	2.88	2.88	3.75	3.60	2.36	2.08	1.84	1.76	1.74	4.55	3.62	2.44
9	2.80	2.78	3.38	4.25	2.30	2.02	1.90	2.10	1.71	3.68	3.15	2.50
10	2.65	2.65	3.70	3.72	2.30	1.92	1.82	1.90	2.45	3.25	2.95	2.56
11	2.50	2.99	3.80	3.35	2.27	1.82	1.80	1.72	2.75	3.35	2.75	2.60
12	3.05	2.92	3.45	3.15	2.22	2.32	1.82	1.62	3.05	3.45	2.75	2.60
13	5.80	2.82	3.90	2.98	2.16	2.70	1.86	1.52	2.95	3.15	3.00	2.60
14	4.75	2.68	3.85	3.35	2.11	2.40	1.81	1.50	2.35	3.00	3.00	2.60
15	4.90	2.58	3.65	4.20	2.06	2.25	1.72	1.50	2.20	4.00	2.92	2.60
16	4.60	2.54	3.48	3.70	2.01	2.08	1.62	1.50	3.40	3.80	2.80	2.85
17	3.35	2.50	3.25	3.35	2.00	1.99	1.60	1.50	3.30	3.50	2.80	3.15
18	3.40	2.48	3.12	3.15	2.00	2.12	1.58	1.50	2.95	5.40	2.95	3.00
19	3.08	2.52	3.35	3.00	1.99	2.70	1.58	1.50	2.58	4.18	3.62	2.96
20	2.90	2.58	4.28	4.45	2.00	2.60	1.56	1.48	2.42	3.52	3.25	2.88
21	3.00	2.52	3.72	3.90	1.96	2.35	1.52	1.42	2.25	3.15	2.98	2.82
22	4.05	2.49	3.42	3.70	1.91	2.15	1.65	1.40	2.50	2.92	2.85	2.72
23	3.72	2.45	3.80	3.75	1.90	2.02	1.70	1.38	2.45	2.95	2.72	3.50
24	3.38	2.48	3.45	3.50	1.89	2.22	1.72	1.36	2.25	2.85	2.78	3.48
25	3.15	2.50	3.20	3.35	1.88	2.30	1.69	1.31	2.22	2.78	3.00	3.38
26	4.65	2.58	2.98	3.22	1.84	2.21	1.65	1.38	2.28	2.68	3.00	3.40
27	4.60	2.88	3.48	3.05	1.79	2.28	1.61	1.75	2.18	2.56	3.00	3.85
28	4.85	3.10	3.20	2.95	1.74	2.58	1.54	1.80	2.15	2.51	3.00	3.65
29	4.50	.....	3.00	2.82	1.71	2.38	1.50	1.78	2.75	2.46	3.10	3.25
30	7.40	.....	3.08	2.68	1.70	2.22	1.50	2.48	2.92	2.38	3.08	3.11
31	4.40	.....	3.02	.....	1.70	.....	1.50	2.80	.....	2.30	.....	3.10

NOTE.—Relation of gage height to discharge probably not affected by ice during 1911.

The data below are taken from U. S. Geological Survey Water-Supply Paper No. 323 for the year 1912:

"**Accuracy.**—***No discharge measurement was made at this

PLATE III.—Cherry Falls, over portion of Webster Springs Sandstone, just southeast of Webster Springs town; Topography of Mauch Chunk Series.

station during 1912. Because of errors in the gage found by wye levels on December 3, 1913 (before the preparation of this report), gage heights of discharge measurements and daily gage heights for this station for 1910 and 1911, published in Water-Supply Papers 283 and 303, should be corrected as follows:

"Gage heights below 6.0 feet:

"August 20 to November 21, 1910, add 0.04 foot.

"November 22, 1910, to February 28, 1911, add 0.03 foot.

"March 1 to June 10, 1911, add 0.02 foot.

"Gage heights above 6.0 feet:

"March 1 to 10, 1911, subtract 0.02 foot.

"June 11 to September 20, 1911, subtract 0.03 foot.

"September 21 to December 31, 1911, subtract 0.04 foot.

"The necessary corrections have been applied to the daily gage heights for 1912 in the following table:"

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for 1912.

[Cherry Woodzell, Observer.]

Day	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.0	3.25	2.90	3.5	2.70	2.00	2.47	3.1	2.15	2.32	2.06	1.96
2	3.5	3.05	2.80	3.7	2.68	1.94	2.40	2.97	2.07	2.19	2.12	2.06
3	3.2	2.92	2.76	3.9	2.67	1.96	2.30	2.75	2.07	2.09	2.07	2.51
4	3.05	2.90	2.68	3.7	2.60	1.98	2.68	2.52	2.07	2.01	2.02	2.61
5	2.96	.....	2.60	3.45	2.56	1.97	3.3	2.41	2.01	1.97	1.96	2.91
6	.....	.....	2.53	3.25	2.49	1.92	2.93	2.29	1.99	1.95	1.96	3.15
7	.....	.....	2.50	3.15	3.15	1.92	2.63	2.19	1.99	1.93	3.85	3.25
8	....	.....	2.50	3.35	3.5	1.87	2.38	2.05	1.89	1.86	4.4	3.05
9	.....	.....	2.88	3.15	3.4	1.80	2.30	2.02	1.81	1.83	3.6	2.91
10	.....	.....	2.99	2.98	3.1	1.77	2.38	2.01	1.76	1.78	3.15	2.74
11	.....	2.40	2.83	2.83	2.88	1.70	2.86	2.05	1.69	1.75	2.84	2.67
12	.....	.....	2.78	2.70	5.6	1.60	2.80	2.29	1.67	1.73	2.68	2.58
13	.....	.....	3.45	2.60	4.6	1.58	2.56	2.17	1.63	1.71	2.58	2.41
14	2.6	.....	3.5	2.50	3.9	1.58	2.93	2.03	1.61	1.72	2.56	2.36
15	.....	.....	5.7	2.48	3.6	1.58	2.98	1.97	1.57	1.68	2.48	2.35
16	.....	.....	5.4	3.5	5.4	2.24	2.93	1.96	1.62	1.67	2.38	2.28
17	.....	.....	4.1	3.4	4.5	2.73	2.80	1.89	1.77	1.67	2.35	2.24
18	.....	2.55	3.7	3.45	4.0	2.48	4.15	1.92	1.79	1.65	2.30	2.22
19	4.0	.....	3.55	3.25	3.6	2.78	4.2	2.32	1.79	1.71	2.26	2.26
20	3.65	.....	4.2	3.05	3.3	2.93	3.45	2.72	1.79	2.27	2.25	2.25
21	3.3	3.5	4.35	2.86	3.05	2.68	3.05	2.59	1.81	2.12	2.21	2.22
22	3.1	4.25	4.1	2.78	2.83	2.48	4.35	2.42	1.77	1.92	2.16	2.21
23	2.78	3.55	3.8	3.5	2.63	2.42	3.65	2.29	1.97	2.02	2.16	2.16
24	2.72	3.2	4.35	3.15	2.43	2.33	3.2	2.19	3.05	2.75	2.16	2.12
25	2.64	2.95	4.6	2.98	2.26	2.30	4.85	2.07	3.05	2.62	2.16	2.04
26	2.58	4.8	3.9	2.87	2.22	2.38	4.0	1.97	2.82	2.49	2.15	1.96
27	2.55	5.4	3.55	2.78	2.19	2.66	3.45	2.05	2.62	2.38	2.14	2.51
28	2.52	4.05	3.2	2.78	2.18	2.93	3.05	2.12	2.49	2.28	2.04	2.56
29	3.25	3.45	4.1	2.72	2.17	2.73	2.92	1.99	2.37	2.20	1.96	2.61
30	4.35	.....	4.6	2.74	2.14	2.53	3.05	2.43	2.45	2.15	1.96	3.9
31	3.6	.....	3.9	.....	2.06	.....	2.97	2.31	.....	2.10	.....	4.35

"NOTE.—Relation of gage height to discharge affected by ice about Jan. 5-19 and Feb. 4-21. Probably little if any effect during December. Observer re-

ported relative to ice as follows: Jan. 6, slush ice, gorged across river; Jan. 14, control partly frozen, river entirely frozen over at gage, ice about 12 inches thick; Jan. 19, ice gorge out; Feb. 3, river partly frozen, ice at gaging section 1 inch thick; Feb. 4, 11, and 18, control partly frozen, river frozen over, ice 2 inches thick on February 4 and 10 inches on other dates; Feb. 21, rain, ice going out; Dec. 23 and 28, river frozen over, ice 2 to 5 inches thick, and Dec. 30, rain, ice gone out."

Water-Supply Paper No. 353, page 66, of the U. S. Geological Survey gives the following data:

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for the year ending Sept. 30, 1913.

[Cherry Woodzell, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.32	2.06	1.96	3.75	3.3	3.4	3.05	3.0	4.0	2.02	1.86	1.82
2	2.19	2.12	2.06	3.35	3.1	3.2	2.97	2.87	3.45	1.94	2.04	1.76
3	2.09	2.07	2.51	3.45	3.25	3.0	2.87	2.75	3.1	1.84	1.96	1.73
4	2.01	2.02	2.61	3.6	4.25	2.89	2.77	2.63	2.89	1.92	1.82	1.69
5	1.97	1.96	2.91	3.55	3.7	2.77	2.75	2.51	2.69	1.94	1.75	1.65
6	1.95	1.96	3.15	4.05	3.35	2.71	2.71	2.44	2.59	3.35	1.68	1.61
7	1.93	3.85	3.25	5.3	3.1	2.63	2.66	2.40	3.0	2.82	1.64	1.65
8	1.86	4.4	3.05	5.8	2.90	2.53	2.59	2.37	3.55	2.42	1.64	1.75
9	1.83	3.6	2.91	4.75	2.75	2.49	2.51	2.27	3.4	2.19	1.63	2.08
10	1.78	3.15	2.74	3.95	2.63	2.63	2.47	2.21	3.1	6.3	1.62	1.88
11	1.75	2.84	2.67	3.6	3.25	3.55	2.46	2.19	2.82	3.7	1.68	1.75
12	1.73	2.68	2.58	3.75	3.7	3.75	3.05	2.14	2.62	3.1	2.04	1.70
13	1.71	2.58	2.41	3.85	3.3	3.5	3.6	2.09	2.49	2.82	2.89	1.72
14	1.72	2.56	2.36	3.5	3.05	4.7	3.45	2.04	2.36	2.56	2.79	1.69
15	1.68	2.48	2.35	3.25	2.90	4.25	5.1	2.06	2.26	2.54	2.44	1.65
16	1.67	2.38	2.28	3.05	2.73	3.85	4.2	2.19	2.16	2.64	2.14	1.60
17	1.67	2.35	2.24	2.85	2.65	3.45	3.7	2.44	2.06	2.56	2.02	1.75
18	1.65	2.30	2.22	2.84	2.57	3.15	3.35	2.89	1.98	2.49	1.92	2.41
19	1.71	2.26	2.26	2.81	2.51	2.97	3.15	2.69	1.95	2.44	2.22	2.08
20	2.27	2.25	2.25	2.78	2.53	2.83	3.0	2.49	1.90	2.43	2.64	1.95
21	2.12	2.21	2.22	2.98	2.63	2.75	2.87	2.36	1.86	2.36	2.42	3.1
22	1.92	2.16	2.21	3.05	2.43	2.67	2.77	2.39	1.78	2.24	2.26	3.25
23	2.02	2.16	2.16	2.96	2.53	2.57	2.63	2.86	1.89	2.12	3.8	2.85
24	2.75	2.16	2.12	3.15	2.85	2.55	2.53	4.5	1.94	2.12	3.15	2.43
25	2.62	2.16	2.04	3.75	2.80	2.45	2.47	3.65	1.94	2.34	2.78	2.21
26	2.49	2.15	1.96	3.5	2.65	2.95	2.47	3.2	2.04	2.34	2.43	2.11
27	2.38	2.14	2.51	3.3	2.85	6.0	2.80	4.95	2.04	2.14	2.24	1.98
28	2.28	2.04	2.56	3.15	3.4	4.55	2.97	5.4	1.96	2.06	2.15	1.92
29	2.20	1.96	2.61	2.94	.....	3.85	3.15	4.25	2.14	1.98	2.05	1.87
30	2.15	1.96	3.9	2.84	.....	3.45	3.2	3.65	2.06	1.95	1.95	1.83
31	2.10	.....	4.35	3.15	.....	3.25	.....	5.3	.....	1.94	1.87	.....

"NOTE.—Observer reported river frozen over, ice 2 to 5 inches thick, Dec. 23 and 28, 1912; and rain, ice gone out, Dec. 30. Discharge relation probably little, if at all, affected by ice during the year ending Sept. 30, 1913."

The following data for the station at Webster Springs for the year ending September 30, 1914, are taken from page 66 of Water-Supply Paper No. 383 of the U. S. Geological Survey:

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for the year ending Sept. 30, 1914.

[Cherry Woodzell, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1 ..	1.88	2.69	3.45	2.72	4.0	2.67	3.85	2.92	1.67	1.92	1.66	1.92
2 ..	1.93	2.51	3.35	2.67	3.5	2.70	5.4	2.82	1.66	1.82	1.62	1.82
3 ..	2.48	2.44	3.2	2.64	3.25	2.75	4.5	2.72	1.62	1.84	1.52	1.80
4 ..	2.58	2.35	3.1	2.58	3.05	2.80	3.8	2.62	1.60	1.81	1.49	1.72
5 ..	2.48	2.29	2.95	2.52	2.98	2.75	3.45	2.95	2.85	2.25	1.50	1.62
6 ..	2.28	2.21	2.80	2.48	3.05	2.60	3.2	4.3	1.92	2.22	1.50	1.58
7 ..	2.13	2.21	3.1	2.45	3.3	2.56	2.95	3.6	1.82	1.95	1.58	1.56
8 ..	2.09	2.73	3.55	2.46	3.3	2.40	4.0	3.35	1.74	1.82	1.56	1.54
9 ..	2.23	3.35	3.3	2.98	3.15	2.40	3.8	3.1	1.68	1.72	1.55	1.51
10 ..	3.0	3.3	3.05	3.75	2.95	2.40	3.65	2.95	1.61	1.66	1.72	1.50
11 ..	2.85	3.1	2.91	3.4	2.82	2.50	3.35	2.80	1.58	1.63	1.72	1.50
12 ..	2.75	3.1	2.81	3.1	2.70	2.50	3.1	2.58	2.25	1.60	1.90	1.58
13 ..	2.58	3.6	2.72	3.0	2.59	2.49	2.92	2.58	2.15	1.55	2.28	1.60
14 ..	2.45	5.4	2.60	3.0	2.62	2.45	2.82	2.48	1.86	1.75	2.15	1.68
15 ..	2.35	6.1	2.56	3.2	2.70	2.62	3.1	2.42	1.76	2.19	1.89	1.65
16 ..	2.25	6.7	2.52	3.2	2.68	3.7	4.25	2.32	1.68	2.38	1.82	1.61
17 ..	2.17	5.1	2.50	2.60	2.72	4.4	4.05	2.29	1.62	2.25	1.72	1.55
18 ..	2.28	4.05	2.50	2.61	2.80	4.15	3.6	2.24	1.58	2.12	1.64	1.52
19 ..	2.68	3.5	2.50	2.59	4.85	3.6	3.25	2.19	1.54	2.09	1.57	1.50
20 ..	3.25	3.25	2.50	3.2	4.9	3.3	3.95	2.13	1.55	1.95	1.52	1.52
21 ..	3.75	3.0	2.48	5.2	3.3	2.99	4.0	2.07	1.68	1.82	1.52	1.52
22 ..	3.35	2.81	2.53	4.05	3.4	2.93	3.5	2.02	1.80	1.80	1.55	1.46
23 ..	2.15	2.67	2.56	3.5	3.25	2.82	3.25	2.00	2.48	1.72	1.54	1.42
24 ..	3.3	2.63	2.56	3.4	3.05	2.89	3.0	1.98	2.82	1.64	1.50	1.44
25 ..	4.25	2.53	2.83	4.6	2.88	3.5	2.88	1.94	4.3	1.69	1.56	1.50
26 ..	4.85	2.43	4.05	3.8	2.78	4.35	3.35	1.88	3.05	1.80	1.75	1.50
27 ..	3.9	2.48	3.5	3.5	2.68	4.95	4.55	1.82	2.62	2.15	2.10	1.49
28 ..	3.4	2.75	3.15	3.3	2.65	5.2	3.6	1.80	2.35	2.04	2.12	1.48
29 ..	3.1	3.2	2.95	3.5	.....	4.6	3.3	1.78	2.15	1.82	2.08	1.48
30 ..	2.85	2.98	2.88	3.7	.....	4.2	3.05	1.74	2.02	1.82	2.11	1.46
31 ..	2.75	.....	2.82	4.45	.....	4.1	.....	1.70	.....	1.72	2.04	.....

"NOTE.—Discharge relation probably affected by ice, Jan. 13-19, Feb. 14-18, and Mar. 2-5."

Discharge measurements of Elk River at Webster Springs, W. Va., during the year ending Sept. 30, 1914.

Date	Made by	Gage height Feet	Discharge Sec.-ft.
Dec. 3..	Peterson and Walters	3.26	610
Dec. 3..	Peterson and Walters	3.24	604

The following data for the station at Webster Springs for the year ending September 30, 1915, are taken from pages 71 and 72 of Water-Supply Paper No. 403 of the U. S. Geological Survey:

"The following discharge measurements were made by Mathers and Morgan: "November 19, 1914: Gage height, 2.05 feet; discharge, 63 second-feet. Gage height, 2.05 feet; discharge, 64 second-feet."

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for the year ending Sept. 30, 1915.

[Cherry Woodzell, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1 ..	1.42	1.99	1.78	3.25	4.35	2.78	2.58	3.0	3.35	1.95	2.20	2.18
2 ..	1.41	1.94	2.70	3.1	6.2	2.72	2.56	2.75	3.15	2.08	2.05	2.06
3 ..	1.39	1.90	2.82	2.82	5.4	2.62	2.52	2.64	4.20	2.03	2.00	2.00
4 ..	1.40	1.88	2.75	2.60	4.3	2.52	2.52	2.58	4.15	1.98	2.15	2.12
5 ..	1.40	1.81	3.35	2.50	3.8	2.55	2.51	2.49	3.65	2.18	2.04	2.35
6 ..	1.40	1.76	3.40	2.48	3.6	2.72	2.60	2.42	3.20	2.45	1.92	2.48
7 ..	1.40	1.74	2.95	6.6	3.45	2.72	3.5	2.40	2.95	2.28	1.82	2.48
8 ..	1.42	1.70	2.81	4.4	3.2	2.58	3.4	2.33	2.80	2.20	1.80	2.35
9 ..	1.50	1.70	2.77	3.65	2.38	2.50	3.3	2.30	2.68	2.30	1.82	2.15
10 ..	1.50	1.70	2.70	3.25	2.86	2.58	3.25	2.22	2.46	2.20	1.90	2.04
11 ..	1.60	1.70	2.64	3.05	2.76	2.62	3.2	2.12	2.34	2.08	1.81	2.00
12 ..	1.62	1.68	2.54	3.2	2.70	2.64	3.2	2.10	2.28	2.02	1.82	1.96
13 ..	1.58	1.64	2.43	3.05	2.82	2.58	3.1	2.09	2.22	2.06	3.15	1.92
14 ..	1.60	1.62	2.34	2.92	3.25	2.58	2.95	2.04	4.8	2.02	2.70	1.92
15 ..	1.65	1.62	2.30	3.1	4.15	2.68	2.82	1.99	3.75	1.92	3.15	2.00
16 ..	2.05	1.66	2.30	3.2	4.0	2.82	2.72	1.98	3.2	1.88	2.90	1.92
17 ..	2.50	2.48	2.30	3.95	3.5	2.88	2.62	1.98	3.05	1.99	2.72	1.82
18 ..	2.25	2.38	2.26	5.6	3.2	2.78	2.54	1.96	3.55	3.20	2.65	1.88
19 ..	2.06	2.04	2.32	5.4	2.95	2.64	2.46	1.95	2.95	2.72	2.55	3.10
20 ..	1.96	2.00	3.8	4.3	2.79	2.58	2.48	1.98	2.70	2.60	2.36	2.70
21 ..	1.86	2.00	3.65	3.6	2.69	2.52	2.48	2.25	2.48	3.60	2.25	2.90
22 ..	1.78	1.94	4.05	3.2	2.62	2.46	2.39	2.45	2.41	3.00	2.42	2.40
23 ..	1.72	1.90	3.4	3.0	2.59	2.41	2.32	2.70	2.34	2.70	2.62	2.56
24 ..	1.77	1.85	3.05	3.2	3.0	2.38	2.30	2.65	2.19	2.48	2.48	2.32
25 ..	2.05	1.81	2.85	3.25	3.6	2.38	2.28	2.52	2.11	2.35	2.42	2.14
26 ..	2.28	1.74	2.75	3.1	3.3	2.75	2.24	2.52	2.02	2.22	2.30	2.02
27 ..	2.18	1.70	2.80	2.98	3.0	2.88	2.21	2.80	1.98	2.11	2.12	2.01
28 ..	2.05	1.70	2.78	2.85	2.94	2.78	2.62	2.65	1.93	2.02	2.08	2.02
29 ..	1.92	1.70	2.85	2.72	.....	2.76	3.7	2.52	1.84	1.94	2.30	2.00
30 ..	1.90	1.74	4.3	2.70	.....	2.70	3.3	3.5	1.80	1.96	2.40	1.98
31 ..	1.98	.....	3.75	2.80	.....	2.62	.....	3.85	.....	2.25	2.32	.....

"NOTE.—Ice in river Dec. 15-18; ice going out Dec. 19. River frozen over Dec. 27 and 28. Ice gone out Dec. 29."

The following data for the year ending September 30, 1916, when the Webster Springs station was abandoned, are taken from Water-Supply Paper No. 433, pages 79-80, of the U. S. Geological Survey:

"The following discharge measurements were made by B. E. Jones:

"September 6, 1916: Gage height, 1.71 feet; discharge, 22.3 second-feet; gage height, 1.69 feet; discharge, 23.8 second-feet. The latter measurement was at the better section."

Daily gage height, in feet, of Elk River at Webster Springs, W. Va., for the year ending Sept. 30, 1916.

[Cherry Woodzell, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1 ..	2.67	1.97	2.59	3.59	4.07	2.77	3.09	3.02	2.95	2.09	1.87	1.77
2 ..	4.32	1.97	2.49	4.79	3.87	2.87	2.95	2.85	2.72	2.05	3.47	1.79
3 ..	3.67	1.97	2.45	3.92	3.55	2.95	2.85	2.72	2.92	2.72	2.87	1.82
4 ..	3.17	1.97	2.37	3.47	2.97	2.80	2.76	2.89	3.02	2.82	2.47	1.87
5 ..	2.85	1.96	2.29	3.17	2.95	2.39	2.71	2.95	2.97	2.52	2.62	1.77
6 ..	2.69	1.96	2.27	3.27	2.87	2.87	2.67	2.82	3.09	2.27	2.62	1.72
7 ..	2.49	1.95	2.27	3.12	3.72	5.07	2.59	2.77	2.99	2.12	2.72	1.77
8 ..	2.41	1.93	2.25	2.97	3.37	4.77	2.57	2.74	3.07	2.07	2.65	1.97
9 ..	2.33	1.93	2.27	2.75	3.19	3.82	2.57	3.02	2.97	2.02	2.87	1.97
10 ..	2.28	1.87	2.27	2.79	3.09	3.42	2.55	2.97	2.95	2.05	3.37	1.92
11 ..	2.23	1.87	2.27	5.52	2.97	3.12	2.89	2.82	2.85	2.22	3.07	1.77
12 ..	2.15	1.87	2.27	4.82	2.97	2.92	3.62	2.66	2.72	2.05	4.02	1.62
13 ..	2.07	2.19	2.27	4.59	4.37	2.87	3.75	2.55	2.47	2.05	3.27	1.57
14 ..	2.01	2.32	2.27	4.12	3.52	3.97	3.47	2.46	2.37	2.07	3.37	1.72
15 ..	1.97	4.02	2.27	3.57	3.29	4.82	3.29	2.41	2.52	1.99	3.67	5.67
16 ..	1.97	3.62	2.25	3.22	3.02	4.02	3.09	2.37	2.67	1.87	3.62	4.12
17 ..	1.97	3.12	3.92	3.17	2.89	3.27	3.02	2.82	3.72	2.27	3.67	3.62
18 ..	1.95	2.89	6.67	3.15	2.79	3.23	3.02	2.72	3.07	2.72	3.12	3.12
19 ..	3.62	2.97	4.52	3.17	2.69	3.09	2.89	2.61	2.77	2.52	2.82	1.97
20 ..	3.27	2.42	3.67	3.22	2.65	2.92	2.79	2.53	2.72	2.22	2.62	1.97
21 ..	2.95	3.25	3.27	3.37	2.92	2.87	2.69	2.41	2.85	2.67	2.42	1.97
22 ..	2.65	3.15	3.02	3.42	2.97	3.77	2.82	2.32	2.72	2.47	2.32	1.92
23 ..	2.51	2.97	2.82	3.87	2.98	4.47	2.99	2.33	2.52	2.87	2.42	1.97
24 ..	2.45	2.82	2.66	3.49	3.07	3.77	2.89	3.37	2.39	2.62	2.47	1.97
25 ..	2.35	2.65	2.65	3.25	4.07	3.45	3.52	2.92	3.12	2.42	2.12	1.92
26 ..	2.27	2.49	3.22	3.02	3.65	3.29	3.92	3.59	3.09	2.27	2.05	1.72
27 ..	2.22	2.72	3.02	2.87	3.35	3.27	3.79	3.52	2.82	2.17	1.97	1.57
28 ..	2.18	2.75	3.17	2.79	3.05	3.52	3.62	3.07	2.55	2.32	2.05	1.57
29 ..	2.13	2.67	5.02	2.87	2.92	3.72	3.39	2.82	2.37	2.17	1.97	3.12
30 ..	2.08	2.65	4.57	3.62	.....	3.49	3.19	2.17	2.22	2.02	1.87	3.57
31 ..	2.01	.....	3.82	3.75	....	3.22	.....	3.22	.....	1.97	1.82	.....

"NOTE.—Ice reported January 18-21 and discharge estimated."

Gauley River.

Gauley River, which, with its tributaries, drains that entire portion of Webster south of Elk River, rises against the Gauley Mountain in western Pocahontas at the high elevation of 4600 feet, flows generally southwestward across Webster and Nicholas, finally uniting with the New River at Gauley Bridge, Fayette County, to form the Great Kanawha. At Allingdale where it crosses the Webster-Nicholas line its elevation is 1990 feet. At Belva where it leaves Nicholas and enters Fayette it is 675 and at Gauley Bridge it is 640, making a total drop of nearly 4000 feet. Its entire length from

head to mouth is 104 miles and that portion in Webster is 37 miles. The area of its entire drainage basin is 1350 square miles and of that portion above Cranberry River 187.19 square miles. The area of Gauley's drainage basin is out of all proportion to its length, due to the fact that several large tributary rivers, which drain an immense fan-shaped basin, converge to form it. Throughout most of its course it is extremely rough and tumultous, having long rapids and occasional low cataracts, its channel being filled with thousands of large boulders from the great sandstone cliffs that line a considerable portion of its steep and narrow valley. There are numerous wide meanders formed during the time of the Cretaceous Peneplain, as the present cycle is that of a young stream with no wide bottoms nor recent meanders. With the exception of a few square miles the entire portion of its drainage basin in Webster is covered with forest, much of which is still virgin woodland. Its principal tributaries in Webster are Straight Creek, Turkey Creek, Miller Mill Run, Williams River, Big Ditch Run, Big Laurel Creek, Coon Creek, and Strouds Creek. The Cranberry River, a considerable portion of whose drainage originates in Webster, empties into the Gauley seven miles below the Nicholas line, and the Cherry River, another large tributary, comes into Gauley only a mile and a half farther down.

From July 3, 1908, to September 30, 1916, the U. S. Geological Survey and the State Survey in conjunction have kept a gaging station on Gauley River at Allingdale, near the line between Nicholas and Webster, the records of which are published below, as taken from Water-Supply Papers Nos. 243, 263, 283, 303, 323, 353, 383, 403, and 433 of the former organization, the following data for 1908 being taken from No. 243, page 85:

"Gauley River at Allingdale, W. Va.

"This station, which is located at the Baltimore and Ohio Railroad bridge about one-fourth mile south of the depot at Allingdale, W. Va., was established July 3, 1908, to obtain data for use in studying water-supply, water-power, flood control, and storage problems.

"Rock Creek enters immediately above the station. The drainage area above the section is about 248 square miles.

"The section at this station is located at a bridge on a curve. The bottom of the stream is rough, but with care accurate measurements can be obtained. Sufficient data have not been obtained to enable estimates of the flow to be made.

"The datum of the gage has remained unchanged. The records are reliable and accurate."

Discharge Measurements of Gauley River at Allingdale, W. Va., in 1908.

Date	Hydrographer	Width Feet	Area of section Sq. Ft.	Gage height Feet	Discharge Sec.-Ft.
July 4....	O'Neill and Chapman..	168	763	6.20	698
July 31....	W. G. Hoyt.....	150	663	5.62	478
July 31a	W. G. Hoyt.....	.....	.....	5.62	458
Sept. 26b	W. M. O'Neill.....	34	23	4.07	6

*a*Measured at wooden bridge.
*b*Wading measurement.

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for 1908.

[Observers, H. N. Wood and J. L. Cogar.]

Day	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.42	4.70	4.10	5.05	4.71
2	.....	5.16	4.61	4.31	4.88	4.85
3	4.98	5.11	4.56	4.20	4.76	4.80
4	5.85	4.94	4.47	4.16	4.62	4.65
5	6.97	5.03	4.49	4.10	4.59	4.50
6	6.59	5.60	4.51	4.14	4.54	4.52
7	6.34	5.81	4.49	4.08	4.44	4.85
8	5.70	5.43	4.43	4.07	4.42	5.69
9	5.39	5.81	4.41	4.10	4.40	5.15
10	5.16	5.99	4.40	4.20	4.40	4.98
11	5.89	5.58	4.38	4.21	4.44	5.72
12	4.86	5.36	4.29	4.20	4.45	5.75
13	4.91	5.26	4.26	4.20	4.44	5.98
14	4.96	5.11	4.20	4.26	4.43	5.33
15	5.24	5.10	4.14	4.30	4.42	5.25
16	5.24	4.91	4.11	4.31	4.40	5.50
17	5.19	4.85	4.10	4.32	4.40	5.08
18	5.14	4.80	4.07	4.38	4.48	5.89
19	5.10	4.85	4.02	4.44	4.56	6.95
20	5.20	4.74	4.00	4.42	4.55	5.96
21	5.05	4.63	3.99	4.47	4.80	5.60
22	5.62	4.69	4.04	4.48	4.90	5.45
23	5.50	4.78	4.00	4.51	4.80	5.34
24	6.72	4.81	3.98	4.54	4.75	5.16
25	5.95	4.82	3.97	4.70	4.70	5.22
26	6.11	5.42	4.00	4.93	4.65	5.65
27	7.56	5.56	4.02	4.95	4.56	5.56
28	8.01	5.20	4.04	4.89	4.65	5.25
29	6.58	5.07	4.08	4.79	4.64	5.30
30	5.94	4.83	4.10	4.89	4.65	5.30
31	5.58	4.75	.....	5.10	.....	6.40

The following records for the Allingdale station for 1909 were obtained from the U. S. Geological Survey Water-Supply Paper No. 263, page 90:

Discharge measurements of Gauley River at Allingdale, W. Va., in 1909.

Date	Hydrographer	Width Feet	Area of section Sq. Ft.	Gage height Feet	Discharge Sec.-Ft.
March 27	H. J. Jackson	169	914	6.75	1,220
Nov. 12	A. H. Horton	166	728	5.96	663

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for 1909.

[J. L. Cogar, Observer.]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.19	5.25	5.98	6.05	7.20	4.99	5.96	4.95	4.12	4.56	5.11	5.05
2	5.85	5.35	5.90	6.10	7.10	4.93	5.47	4.79	4.07	4.50	5.07	5.05
3	5.65	5.33	5.85	6.11	6.63	5.05	5.28	4.76	4.07	4.47	5.08	5.04
4	5.47	5.34	6.40	6.23	6.44	5.01	5.03	4.59	4.06	4.41	5.11	5.05
5	5.51	5.49	6.18	6.49	6.20	5.47	5.00	4.49	4.24	4.36	5.01	5.03
6	6.99	6.10	6.10	7.20	5.98	5.37	4.96	4.44	4.31	4.35	4.97	5.00
7	6.61	6.42	6.11	6.89	5.75	5.38	5.47	4.37	4.52	4.28	4.96	4.96
8	6.05	6.08	7.32	6.34	7.03	5.43	5.18	4.33	4.37	4.26	4.96	5.05
9	5.82	5.93	6.79	6.01	6.18	5.56	5.00	4.44	4.28	4.21	5.71	5.15
10	5.63	7.14	8.62	5.83	6.15	5.59	4.83	4.37	4.36	4.18	7.07	5.05
11	5.56	7.18	7.58	5.53	7.20	5.88	4.78	4.32	4.92	4.28	6.55	4.90
12	5.60	6.44	6.70	5.52	6.55	5.68	4.68	4.28	4.90	6.61	6.06	5.10
13	5.65	6.27	6.35	5.50	6.20	5.65	4.78	4.25	4.62	5.28	5.75	5.15
14	5.45	6.92	6.80	10.72	5.90	5.39	5.05	4.17	4.48	6.31	5.30	7.55
15	8.60	7.14	6.55	7.92	5.70	5.40	5.25	4.42	4.39	5.17	5.36	6.40
16	7.90	8.47	6.26	6.87	5.50	6.46	5.04	5.59	7.77	5.16	5.30	5.95
17	7.36	7.56	6.10	6.38	5.51	5.83	4.90	5.21	5.92	5.08	5.26	5.85
18	6.64	6.90	5.80	6.05	5.50	5.99	4.85	5.07	5.26	5.01	5.20	6.20
19	6.22	6.45	5.73	5.85	5.20	5.88	4.73	4.87	5.01	5.08	5.00	5.20
20	6.08	7.29	5.63	5.81	5.12	5.58	4.74	4.72	4.86	5.45	4.90	4.98
21	5.96	6.80	5.65	6.75	5.10	5.38	4.68	4.59	4.66	5.25	4.85	4.92
22	5.90	7.35	6.69	7.94	5.97	5.23	4.53	4.48	4.64	5.21	4.80	4.90
23	5.91	6.90	6.26	7.70	5.45	5.14	4.77	4.46	4.56	5.16	5.05	5.01
24	6.11	6.65	6.24	7.75	5.27	5.15	4.82	4.37	5.51	6.61	5.49	4.95
25	5.95	7.27	6.28	6.85	5.12	5.88	5.07	4.32	5.44	6.11	5.35	4.90
26	5.80	6.65	7.12	6.47	5.15	5.07	4.89	4.27	5.48	5.87	5.25	4.80
27	5.62	6.45	6.94	6.25	5.47	5.04	4.69	4.25	4.94	5.72	5.15	4.84
28	5.58	6.44	7.36	7.01	5.50	5.00	4.65	4.22	4.81	5.56	5.13	4.86
29	5.50	.....	7.05	6.69	5.48	5.03	4.67	4.19	4.71	5.41	5.17	4.80
30	5.49	.....	6.61	6.40	5.28	5.15	4.69	4.17	4.68	5.31	5.15	4.82
31	5.48	.....	6.26	.....	5.08	.....	4.62	4.09	.....	5.26	.....	4.80

The following data for year 1910 were taken from the U. S. Geological Survey Water-Supply Paper No. 283, page 80:

Discharge Measurements of Gauley River at Allingdale, W. Va., in 1910.

Date	Hydrographer	Width Feet	Area of section Sq. Ft.	Gage height Feet	Discharge Sec.-Ft.
Mar. 12..	A. H. Horton	156	506	5.48	a 371
Mar. 12..	A. H. Horton	154	694	5.47	406
Aug. 15..	Bailey and Dort	109	109	4.43	b 77.4

*a*Above regular section.
*b*Measurement not at regular section.

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for 1910.

[J. L. Cogar, Observer.]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ..	4.85	5.50	8.95	5.03	5.52	5.45	5.20	4.65	4.64	5.20	5.03	5.70
2 ..	5.96	5.80	7.58	5.00	5.41	6.30	5.05	4.62	4.40	5.10	5.07	5.61
3 ..	8.85	5.50	7.12	4.99	5.30	5.96	4.94	4.59	4.97	5.02	5.10	5.45
4 ..	8.55	5.80	6.68	5.03	5.30	5.94	4.92	4.55	5.15	4.95	5.25	5.43
5 ..	6.99	5.80	6.32	5.55	5.25	5.90	6.49	4.70	5.36	4.80	5.20	5.45
6 ..	6.48	5.68	6.23	5.35	5.15	8.70	6.41	4.65	6.17	4.73	5.12	5.60
7 ..	10.45	5.60	6.25	5.36	5.11	7.18	5.60	4.50	5.37	4.70	5.05	5.52
8 ..	7.33	5.25	6.00	5.30	5.09	6.40	6.80	4.45	5.20	4.75	5.00	5.48
9 ..	7.10	5.35	5.73	5.23	5.61	6.20	6.00	4.41	5.12	5.40	4.90	5.55
10 ..	6.11	5.62	5.62	5.20	5.80	6.60	5.65	4.40	5.10	5.33	4.89	5.22
11 ..	6.20	5.65	5.50	5.18	5.65	7.10	5.30	4.39	4.92	5.10	4.90	5.20
12 ..	5.80	5.52	5.49	5.15	8.35	7.25	5.20	4.40	4.85	4.95	4.88	5.22
13 ..	5.61	5.20	5.34	6.00	7.50	7.35	6.75	4.41	4.74	4.85	4.85	5.10
14 ..	5.90	5.30	5.32	5.90	6.60	7.15	6.65	4.38	6.60	4.75	4.75	4.85
15 ..	6.05	5.32	5.30	5.61	6.00	7.05	6.25	4.45	5.75	4.72	4.71	4.95
16 ..	5.50	5.50	5.35	5.52	5.94	11.32	6.10	4.32	5.71	4.67	4.85	5.05
17 ..	5.65	7.68	5.40	5.60	5.55	9.50	5.85	4.34	5.18	4.65	4.77	4.95
18 ..	5.61	8.50	5.25	5.65	5.60	8.10	5.90	4.31	5.04	4.62	4.74	5.11
19 ..	8.85	7.12	5.20	5.69	5.80	7.49	5.72	4.29	4.90	4.59	4.70	5.17
20 ..	7.10	6.58	5.20	6.00	5.70	6.98	5.45	4.31	4.86	4.53	4.61	5.72
21 ..	6.60	6.24	5.21	6.49	5.65	6.35	5.29	4.10	4.89	4.50	4.50	5.64
22 ..	7.35	6.82	5.36	6.60	5.62	6.10	5.11	4.20	4.70	4.64	4.70	5.30
23 ..	6.59	6.56	5.34	7.00	5.70	5.80	5.00	4.75	4.69	4.73	4.68	5.35
24 ..	6.20	6.50	5.30	7.20	5.52	5.70	5.02	4.70	4.61	4.95	4.70	6.10
25 ..	5.85	6.05	5.30	7.01	5.60	5.50	4.88	4.50	5.44	4.90	4.85	6.05
26 ..	5.65	5.90	5.28	6.55	5.70	5.36	4.86	4.41	7.78	4.71	5.50	5.70
27 ..	5.98	5.75	5.20	6.20	5.62	5.25	5.10	4.35	5.75	4.70	5.47	5.68
28 ..	6.10	6.26	5.18	6.00	5.45	5.20	4.90	4.32	6.05	4.90	5.40	5.40
29 ..	5.95	.....	5.10	5.81	5.42	5.60	4.80	4.30	5.70	5.30	6.85	5.95
30 ..	5.70	.....	5.05	5.70	5.40	5.40	4.72	4.22	5.36	5.15	5.85	10.14
31 ..	5.60	.....	5.04	.....	5.48	.....	4.70	4.21	.....	5.05	.....	7.95

"NOTE.—No ice reported by observer; relation of gage height to discharge probably not affected by ice."

The following records for 1911 were obtained from the U. S. Geological Survey Water-Supply Paper No. 303, pages 52 and 53:

"Point of zero flow.—Levels taken August 15, 1910, indicate that there would be no flow past the gage if the river stage were to fall to 3.33 feet ± 0.2 foot."

Discharge measurements of Gauley River at Allingdale, W. Va., in 1911.

Date	Hydrographer	Gage height Feet	Discharge Sec.-ft.
Oct. 24....	Bailey and Perwien	5.82	599
Oct. 24....	Bailey and Perwien	5.80	a 586
Oct. 27....	Bailey and Perwien	5.40	380

*a*Measurement made at wooden bridge above regular section.

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for 1911.

[J. L. Cogar, Observer.]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ..	7.43	7.64	5.71	5.78	5.93	4.63	5.41	4.05	5.28	4.39	5.02	5.65
2 ..	9.34	7.45	5.63	5.84	6.23	4.65	5.04	4.05	5.18	4.44	4.98	5.54
3 ..	9.61	7.00	5.43	5.88	5.98	4.63	4.61	4.07	4.28	4.51	4.92	5.45
4 ..	8.13	6.85	5.51	6.75	5.93	4.61	4.53	4.06	4.26	5.13	4.90	5.46
5 ..	6.93	6.23	5.57	6.90	5.74	4.60	4.52	4.03	4.26	5.08	4.85	5.50
6 ..	6.61	6.08	6.38	8.40	5.68	4.60	4.50	4.03	4.23	5.03	4.90	5.52
7 ..	6.28	5.99	8.01	7.13	5.44	4.58	6.33	4.07	4.21	5.58	7.69	5.49
8 ..	6.18	5.93	6.98	6.73	5.25	4.51	5.98	5.13	4.24	9.18	6.60	5.46
9 ..	5.75	6.13	6.59	6.33	5.12	4.45	5.28	4.83	6.55	8.43	6.35	5.38
10 ..	5.48	5.95	6.44	6.01	5.11	4.40	5.13	4.51	5.33	8.05	6.21	5.35
11 ..	5.53	5.83	6.72	5.93	5.08	4.38	5.41	4.43	5.13	7.83	5.94	5.34
12 ..	5.59	5.75	6.75	5.90	5.03	4.93	5.43	4.34	5.11	7.33	5.53	5.34
13 ..	10.58	5.70	6.83	6.23	5.02	5.11	5.28	4.28	5.13	6.45	5.51	5.35
14 ..	9.38	5.63	6.98	6.84	4.93	5.12	4.88	4.24	5.17	6.28	5.43	5.30
15 ..	9.05	5.53	6.65	7.73	4.85	5.55	4.73	4.21	5.18	6.83	5.33	5.32
16 ..	8.40	5.45	6.23	6.24	4.48	4.58	4.63	4.45	7.65	6.68	5.41	5.40
17 ..	7.18	5.23	6.15	5.28	4.35	4.53	4.53	4.48	6.78	7.28	5.50	6.10
18 ..	6.53	5.18	6.08	5.24	4.28	4.59	4.44	4.43	6.28	9.18	5.82	6.04
19 ..	6.13	5.29	6.59	6.05	4.28	4.63	4.43	4.34	6.18	7.58	6.79	6.00
20 ..	5.90	5.53	8.32	6.93	4.30	4.59	4.43	4.18	5.53	7.08	6.32	5.90
21 ..	5.83	5.42	7.39	7.13	4.43	4.47	4.41	4.18	5.23	6.13	5.89	5.91
22 ..	7.48	5.39	6.33	6.93	4.53	4.40	4.43	4.16	5.08	6.08	5.81	6.02
23 ..	7.18	5.42	6.38	6.89	4.58	4.38	4.43	4.14	5.04	6.04	5.65	6.01
24 ..	6.43	5.63	6.33	6.88	4.58	4.35	4.42	4.13	5.01	5.93	5.58	6.12
25 ..	6.25	5.53	6.25	6.35	4.56	4.48	4.40	4.11	4.28	5.81	5.53	6.45
26 ..	6.68	5.52	6.13	6.18	4.54	5.08	4.35	4.09	4.24	5.82	5.56	6.55
27 ..	7.62	5.51	5.98	5.98	4.53	5.28	4.33	4.07	4.23	5.80	5.79	6.80
28 ..	8.23	5.73	5.92	5.62	4.53	5.53	4.31	4.07	4.22	5.31	5.71	6.69
29 ..	9.18	.....	5.92	5.59	4.50	5.41	4.30	4.13	4.28	5.19	5.70	6.63
30 ..	16.08	.....	5.94	5.73	4.48	5.28	4.18	5.23	4.34	5.15	5.68	5.95
31 ..	8.44	.....	6.05	.....	4.47	.....	4.08	6.08	.....	5.09	.....	6.30

"NOTE.—Observer made no report concerning ice. Relation of gage height to discharge probably not affected by ice during 1911."

The following data for the station at Allingdale, for the year 1912, are taken from page 58 of Water-Supply Paper No. 323 of the U. S. Geological Survey:

"The following discharge measurement was made by C. T. Bailey:
"March 21, 1912: Gage height, 7.65 feet; discharge, 2,060 second-feet."

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for 1912.

[Harry Jones, Observer.]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.2	7.6	6.25	6.7	5.9	4.71	5.25	7.2	5.15	5.15	5.0	4.80
2	6.65	7.2	5.95	6.6	5.85	4.65	5.15	6.2	5.0	5.05	5.15	4.89
3	6.6	7.0	5.90	7.6	5.80	4.54	5.15	5.75	4.98	5.0	5.15	5.2
4	6.15	7.0	5.6	7.0	5.6	4.78	5.45	5.5	4.96	4.90	5.05	5.5
5	5.6	6.7	5.45	6.6	5.5	4.77	6.4	5.3	5.1	4.84	5.0	5.9
6	5.2	6.65	5.35	6.25	5.45	4.57	6.05	5.15	4.90	4.78	4.98	6.4
7	5.2	6.4	5.25	6.05	5.6	4.57	5.6	5.0	4.94	4.75	5.05	6.5
8	5.3	5.8	5.25	6.65	6.05	4.54	5.25	4.9	4.82	4.70	9.0	6.25
9	5.35	5.6	5.6	6.3	6.35	4.42	5.1	4.85	4.98	4.68	7.0	5.9
10	5.3	5.35	5.8	6.0	6.0	4.37	5.4	4.78	4.66	4.64	6.2	5.65
11	5.3	5.1	5.7	5.8	5.75	4.36	6.55	4.87	4.68	4.60	5.9	5.6
12	5.2	5.05	5.8	5.65	11.1	4.20	6.05	5.25	4.54	4.60	5.65	5.6
13	5.15	5.0	6.05	5.55	8.6	4.20	5.45	5.5	4.50	4.60	5.5	5.4
14	5.0	4.98	6.7	5.45	8.1	4.22	5.3	5.05	4.47	4.60	5.5	5.05
15	5.0	4.75	6.6	5.3	6.75	4.18	5.8	4.88	4.46	4.60	5.4	5.15
16	5.0	4.97	10.6	5.25	7.7	4.12	7.1	4.78	4.42	4.62	5.3	5.4
17	5.05	5.0	7.8	5.95	8.8	4.22	6.05	4.70	4.44	4.62	5.25	5.4
18	5.1	5.05	7.0	6.2	7.6	5.15	5.8	4.62	4.68	4.62	5.2	5.1
19	5.3	5.15	6.9	6.3	6.85	6.05	8.7	4.80	4.70	4.74	5.15	5.1
20	6.45	5.2	7.3	5.95	6.35	6.1	6.7	5.7	4.76	5.35	5.15	5.15
21	6.0	6.05	7.8	5.7	6.0	5.45	6.0	5.5	4.68	5.15	5.15	5.1
22	6.05	7.6	8.0	5.55	5.75	5.1	7.5	5.3	4.52	4.95	5.15	5.9
23	6.15	6.8	6.9	6.0	5.55	4.98	6.65	5.3	4.54	5.05	5.15	4.7
24	6.25	6.6	7.1	5.95	5.35	5.15	6.0	5.3	6.85	6.1	4.98	5.0
25	6.15	5.95	8.8	6.75	5.2	5.1	9.7	4.96	6.3	5.7	4.98	4.85
26	6.05	6.35	7.4	5.6	5.15	5.6	8.0	4.86	5.65	5.45	4.90	4.86
27	5.7	11.8	6.7	5.5	5.05	6.1	6.7	5.1	5.55	5.45	4.85	5.0
28	5.25	7.2	6.25	5.7	4.96	6.5	6.05	5.0	5.5	5.3	4.75	5.2
29	6.9	6.7	8.3	5.5	4.93	5.8	5.7	5.95	5.3	5.2	5.0	a5.3
30	10.2	.....	8.6	5.8	4.92	5.45	5.9	5.8	5.3	5.1	4.68	5.4
31	7.7	.....	7.4	.....	4.83	.....	5.75	5.35	.....	5.1	.....	8.5

aGage height to top of ice.

"NOTE.—Relation of gage height to discharge probably affected by ice Jan. 6-19, and possibly at times during February. The observer reported on Apr. 1 that the river did not freeze over at the bridge, probably because of being high and swift at the gage, during the cold periods, but that on the pools both above and below the gage at a distance of about 200 yards the ice ranged from about 10 inches thick at the banks to about 5 inches thick at the center: that on Feb. 27 the ice began to break up and quite a large quantity came down from above, after which date there was no ice."

The following records for the station at Allingdale, for the year ending September 30, 1913, are taken from page 61 of the U. S. Geological Survey Water-Supply Paper No. 353:

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for the year ending Sept. 30, 1913.

[Harry Jones, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1 ..	5.15	5.0	4.80	6.2	6.6	6.4	6.1	6.25	7.6	5.05	4.61	4.44
2 ..	5.05	5.15	4.89	6.3	6.15	6.2	5.9	5.95	6.65	4.95	4.62	4.35
3 ..	5.0	5.15	5.2	6.7	6.3	5.8	5.7	5.75	5.95	4.77	4.47	4.30
4 ..	4.90	5.05	5.5	6.6	8.5	5.85	5.6	5.55	5.8	6.25	4.37	4.26
5 ..	4.84	5.0	5.9	6.2	7.2	5.7	5.55	5.4	5.65	5.4	4.35	4.24
6 ..	4.78	4.98	6.4	7.2	6.2	5.6	5.5	5.35	5.4	6.0	4.31	4.14
7 ..	4.75	5.05	6.5	9.1	6.05	5.35	5.35	5.3	5.35	5.95	4.28	4.22
8 ..	4.70	9.0	6.25	10.1	6.0	5.2	5.3	5.2	6.6	5.5	4.26	4.79
9 ..	4.68	7.0	5.9	9.1	5.9	5.4	5.25	5.15	6.55	5.25	4.26	4.76
10 ..	4.64	6.2	5.65	7.4	6.0	5.45	5.2	5.05	6.0	5.35	4.27	4.56
11 ..	4.60	5.9	5.6	6.7	5.85	6.0	5.2	4.95	5.6	6.15	4.26	4.43
12 ..	4.60	5.65	5.6	6.5	7.3	7.0	6.0	4.92	5.45	5.3	4.86	4.36
13 ..	4.60	5.5	5.4	7.4	6.4	6.55	6.0	4.87	5.25	5.45	5.35	4.34
14 ..	4.60	5.5	5.05	6.7	6.25	7.2	6.3	4.85	5.1	5.3	5.1	4.27
15 ..	4.60	5.4	5.15	6.2	6.0	7.7	8.1	4.85	5.0	5.2	4.76	4.14
16 ..	4.62	5.3	5.4	6.0	5.9	7.3	8.1	4.89	4.87	5.5	4.56	4.15
17 ..	4.62	5.25	5.4	5.8	5.6	6.6	7.1	5.25	4.87	5.35	4.59	4.25
18 ..	4.62	5.2	5.1	5.7	5.85	6.2	6.4	6.0	4.75	5.15	4.61	4.99
19 ..	4.74	5.15	5.1	5.7	5.7	5.95	6.1	5.6	4.62	5.15	4.71	4.74
20 ..	5.35	5.15	5.15	5.65	5.3	5.8	6.0	5.45	4.59	5.95	5.1	4.71
21 ..	5.15	5.15	5.1	5.5	5.45	5.65	5.7	5.3	4.59	5.35	4.76	5.45
22 ..	4.95	5.15	5.9	6.0	5.8	5.65	5.55	5.55	4.54	5.15	4.83	5.4
23 ..	5.05	5.15	4.7	6.75	6.15	5.3	5.55	5.65	4.69	5.05	6.5	5.25
24 ..	6.1	4.98	5.0	6.1	5.8	5.35	5.4	8.9	4.85	5.45	5.8	5.2
25 ..	5.7	4.98	4.85	7.1	5.65	5.35	5.5	7.1	4.72	5.35	5.15	4.96
26 ..	5.45	4.90	4.86	6.85	5.5	5.65	5.25	6.4	7.4	5.25	4.96	4.16
27 ..	5.45	4.85	5.0	6.45	5.6	11.0	5.5	9.4	5.5	5.15	4.85	4.56
28 ..	5.3	4.75	5.2	6.15	6.25	8.7	6.3	10.3	5.4	5.0	4.70	4.57
29 ..	5.2	5.0	a5.3	5.9	.....	7.2	6.2	8.1	5.05	4.86	4.75	4.65
30 ..	5.1	4.68	5.4	5.75	.....	6.7	6.7	6.95	4.97	4.76	4.56	4.68
31 ..	5.1	.....	8.5	5.8	.....	6.3	.....	11.2	.....	4.68	4.50	.....

*a*Gage height to top of ice.

"NOTE.—Observer made no notes relative to ice during 1913. Discharge relation probably not materially affected by ice during the year ending Sept. 30, 1913."

The following data for the station at Allingdale, for the year ending September 30, 1914, are taken from page 61 of Water-Supply Paper No. 383 of the U. S. Geological Survey:

"The following discharge measurement was made by Peterson and Walters:

"December 1, 1913: Gage height, 5.97 feet; discharge, 701 second-feet."

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for the year ending Sept. 30, 1914.

[Harry Jones, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1 ..	4.87	5.45	5.9	5.6	7.5	5.5	7.3	5.8	4.33	4.46	4.15	4.98
2 ..	4.67	5.35	7.6	5.5	6.6	5.1	10.1	.....	5.35	4.29	4.13	4.81
3 ..	6.0	5.25	6.85	5.45	6.2	5.0	8.6	.....	5.35	4.31	4.07	4.78
4 ..	5.2	5.25	6.4	5.35	5.95	5.4	7.3	.....	5.3	4.17	4.05	4.45
5 ..	5.4	5.15	6.1	5.4	5.85	5.3	6.6	.....	5.3	4.23	4.03	4.55
6 ..	5.0	5.1	5.75	5.3	5.85	5.3	6.25	.....	5.35	4.18	4.09	4.46
7 ..	4.91	5.0	6.0	5.3	6.3	5.3	5.95	.....	4.33	4.31	4.18	4.43
8 ..	4.76	5.0	6.9	5.3	6.5	5.25	6.95	.....	4.31	4.26	5.25	4.43
9 ..	5.05	5.7	6.35	5.7	6.0	5.1	8.4	.....	4.28	4.30	5.4	4.38
10 ..	5.7	6.1	6.05	5.65	6.05	5.55	6.9	.....	4.28	4.11	4.84	4.45
11 ..	5.55	5.9	5.9	6.2	5.8	5.3	6.4	.....	4.21	4.07	4.83	4.43
12 ..	5.3	5.8	5.7	5.9	6.05	5.55	6.15	.....	4.18	4.06	4.80	4.48
13 ..	5.3	6.05	5.6	6.2	5.4	5.65	5.95	.....	4.04	4.03	5.45	4.47
14 ..	5.05	8.7	5.5	6.05	5.3	5.7	5.7	.....	4.08	4.23	4.95	4.48
15 ..	4.92	10.4	5.4	5.6	5.25	5.55	5.6	.....	4.18	4.31	4.81	4.48
16 ..	4.89	11.5	5.35	5.45	5.1	6.55	7.5	.....	4.16	4.83	4.63	4.38
17 ..	4.88	10.0	5.3	5.45	5.35	8.1	7.7	.....	4.08	4.71	4.53	4.31
18 ..	4.86	8.7	5.3	5.4	5.2	7.2	5.95	.....	4.08	4.58	4.43	4.24
19 ..	5.55	6.75	5.5	5.3	6.3	6.1	6.4	.....	4.02	4.48	4.33	4.16
20 ..	5.5	6.25	5.25	5.45	9.4	6.3	7.7	.....	3.98	4.36	4.28	4.47
21 ..	6.95	5.95	5.3	9.7	7.3	6.0	7.8	.....	3.93	4.25	4.23	4.30
22 ..	6.2	5.7	5.25	8.5	6.55	6.25	6.9	.....	4.08	4.15	4.67	4.18
23 ..	6.25	5.55	5.2	6.5	6.25	5.7	6.45	.....	4.29	4.11	4.63	4.13
24 ..	6.25	5.45	5.35	6.3	5.95	5.65	6.1	4.71	5.1	4.11	4.49	4.17
25 ..	7.9	5.25	5.35	9.3	5.9	6.1	5.9	4.67	5.0	4.23	4.38	4.28
26 ..	10.4	5.25	6.95	7.3	5.75	7.4	7.2	4.58	5.65	4.26	4.68	4.44
27 ..	7.9	5.2	6.3	6.65	5.75	9.0	8.2	4.43	5.1	4.23	5.7	4.33
28 ..	7.6	5.35	6.0	6.35	5.5	9.2	7.0	4.33	4.76	4.59	5.15	4.33
29 ..	6.6	6.4	5.85	5.75	.....	8.4	6.4	4.53	4.55	4.26	5.65	4.26
30 ..	6.15	5.0	5.75	7.1	.....	7.8	6.0	4.83	4.53	4.24	5.5	4.23
31 ..	5.85	.....	5.6	7.4	.....	8.2	.....	4.38	.....	4.15	5.15	.....

"NOTE.—Discharge relation probably affected by ice about Jan. 13-18. No record May 2-23."

The following data are taken from the U. S. Geological Survey Water-Supply Paper No. 403. page 67, for the year ending September 30, 1915:

"The following discharge measurements were made by J. G. Mathers:

"November 21, 1914: Gage height, 4.74 feet; discharge, 90 second-feet. Gage height, 4.72 feet; discharge, 88 second-feet."

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for the year ending Sept. 30, 1915.

[Harry Jones, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1 ..	4.16	4.83	4.78	6.2	7.7	5.75	5.25	6.15	6.2	4.98	5.35	4.93
2 ..	4.13	4.70	5.5	5.95	12.2	5.6	5.2	5.8	5.95	4.95	5.55	4.86
3 ..	4.12	4.71	5.65	5.8	10.5	5.6	5.25	5.65	8.8	4.88	5.5	5.08
4 ..	4.11	4.70	5.7	5.8	7.8	5.4	5.2	5.55	7.5	4.84	5.3	5.40
5 ..	4.15	4.68	7.8	6.0	7.1	5.45	5.10	5.45	6.3	4.80	5.1	6.06
6 ..	4.17	4.66	6.7	6.35	6.75	5.6	5.2	5.35	6.3	5.5	4.80	5.85
7 ..	4.15	4.61	5.95	12.7	6.45	5.6	6.4	5.25	5.8	5.2	4.81	5.43
8 ..	4.43	4.07	5.75	8.1	6.1	5.55	6.8	5.25	5.6	5.05	4.80	5.23
9 ..	4.41	4.58	5.5	6.8	5.85	5.35	6.55	5.35	5.45	5.5	4.80	5.10
10 ..	4.58	4.58	5.35	6.2	6.0	5.4	6.4	5.05	5.2	5.2	4.75	4.98
11 ..	4.67	4.56	5.50	5.95	6.2	5.45	6.35	4.96	5.05	5.1	4.72	4.88
12 ..	4.65	4.53	5.4	6.7	5.75	5.45	6.6	4.91	5.05	5.1	4.73	4.78
13 ..	4.61	4.45	5.25	6.45	5.55	5.8	6.15	4.95	5.0	5.85	5.7	5.68
14 ..	4.59	4.38	5.2	5.95	5.9	5.4	5.9	4.95	9.3	4.91	5.1	5.18
15 ..	5.2	4.07	4.93	6.2	6.35	5.4	5.7	4.88	6.7	4.95	5.0	4.88
16 ..	5.1	5.7	4.70	6.35	7.9	5.45	5.6	4.73	6.2	4.9	5.25	4.78
17 ..	5.55	5.55	4.93	6.15	6.7	5.6	5.55	4.78	6.2	6.55	5.4	4.68
18 ..	5.15	5.25	5.05	9.2	6.25	5.45	5.35	4.70	5.75	7.7	6.15	4.66
19 ..	4.98	5.1	5.2	10.6	5.95	5.6	5.35	4.70	5.75	5.75	5.4	4.58
20 ..	4.86	4.93	7.8	7.8	5.7	5.4	5.3	4.68	5.3	5.7	5.25	3.98
21 ..	4.75	4.71	6.7	6.7	5.6	5.4	5.25	4.85	5.1	6.25	5.2	5.18
22 ..	4.68	4.80	8.0	6.3	5.15	5.25	4.86	4.95	5.35	5.9	5.45	5.48
23 ..	4.60	4.65	6.45	6.05	5.4	5.2	5.15	5.1	5.1	5.55	5.3	5.13
24 ..	4.15	4.50	6 55	6.95	5.55	5.15	5.3	5.45	4.9	5.35	5.35	4.98
25 ..	4.93	4.70	6.8	6.45	7.0	5.1	5.25	5.3	4.78	5.25	5.35	4.83
26 ..	5.3	4.75	5.7	6.3	6.35	5.15	5.15	5.8	4.68	5.0	5.3	4.83
27 ..	5.1	4.70	5.5	6.05	6.05	5.6	5.1	5.95	4.65	5.1	5.05	5.13
28 ..	4.95	4.70	5.35	5.8	5.85	5.5	5.95	5.5	4.57	4.85	5.05	5.03
29 ..	4.87	4.68	5.4	5.8	.....	5.45	7.1	5.4	4.46	4.75	5.65	4.93
30 ..	4.88	4.53	7.4	5.65	.....	5.4	6.55	6.25	4.52	5.0	5.25	4.08
31 ..	4.90	.....	6.8	5.5	.....	5.3	.....	7.4	.....	5.8	5.10	.....

"NOTE.—No ice reported by observer."

The following data for the year ending September 30, 1916, when the gaging station at Allingdale was abandoned, are taken from pages 74-75 of Water-Supply Paper No. 433 of the U. S. Geological Survey:

"The following discharge measurement was made by B. E. Jones:

"September 4, 1916: Gage height, 4.48 feet; discharge, 48.4 second-feet."

Daily gage height, in feet, of Gauley River at Allingdale, W. Va., for the year ending Sept. 30, 1916.

[Harry Jones, Observer.]

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1 ..	11.16	4.80	5.18	6.25	7.35	5.80	6.20	5.85	5.45	4.90	4.57	4.55
2 ..	8.18	4.90	5.33	8.85	7.55	5.80	6.05	5.65	5.31	4.90	6.95	5.41
3 ..	7.28	4.48	5.28	7.30	6.20	5.81	5.80	5.46	5.70	4.90	5.40	4.39
4 ..	6.38	4.68	5.28	6.50	6.00	5.73	5.70	5.61	6.57	4.69	5.03	4.43
5 ..	5.90	4.60	5.13	6.15	6.19	5.63	5.55	5.95	5.95	5.15	6.35	4.36
6 ..	5.83	4.50	5.18	6.05	5.77	5.80	5.38	5.80	6.70	4.90	5.40	4.26
7 ..	5.15	4.63	5.28	6.00	6.85	8.10	5.35	5.61	6.15	4.75	5.41	4.18
8 ..	5.33	4.58	5.13	6.10	6.29	9.05	5.35	5.50	6.40	4.78	5.53	4.74
9 ..	5.25	4.60	4.98	5.95	6.46	7.00	5.32	9.45	6.47	4.59	6.46	4.62
10 ..	5.16	4.63	4.93	5.85	6.20	6.50	5.40	5.90	6.26	4.65	7.51	4.53
11 ..	5.08	4.61	4.78	8.25	5.99	6.15	5.57	5.69	5.87	5.25	6.26	4.37
12 ..	5.28	4.68	5.08	10.00	6.10	5.93	5.54	5.60	5.47	4.90	7.12	4.28
13 ..	4.94	4.73	4.98	7.90	6.58	5.90	7.00	5.39	5.40	4.65	6.27	4.23
14 ..	4.75	4.98	4.93	7.70	6.40	6.20	6.74	5.31	5.33	4.61	7.01	4.17
15 ..	4.45	6.13	4.88	6.60	6.20	8.40	6.35	5.30	5.52	4.58	6.19	7.50
16 ..	4.77	6.98	4.98	6.38	6.05	7.10	5.98	5.10	6.25	4.46	5.85	6.28
17 ..	4.70	6.18	6.48	6.50	5.95	6.70	6.55	5.21	7.30	4.77	7.15	5.32
18 ..	6.48	5.73	10.48	6.40	5.65	6.25	6.85	5.30	6.00	5.49	5.77	5.54
19 ..	6.45	5.83	8.58	5.60	5.64	6.18	5.55	5.14	5.52	5.10	5.57	4.55
20 ..	5.88	6.58	7.23	5.55	5.46	5.85	5.50	5.08	5.35	5.00	5.52	4.45
21 ..	5.64	6.33	6.33	5.95	5.65	5.95	5.39	4.99	5.35	4.90	5.36	4.72
22 ..	5.41	6.08	5.98	6.45	5.75	6.15	5.53	4.95	5.45	7.30	5.08	4.65
23 ..	5.34	5.88	5.83	7.35	5.75	8.65	5.65	5.05	5.21	5.75	5.80	4.60
24 ..	5.21	5.70	5.58	6.70	5.95	7.26	5.56	6.33	5.05	5.97	5.25	4.46
25 ..	5.15	5.58	5.81	6.20	6.25	6.65	5.75	5.56	6.18	5.35	5.07	4.52
26 ..	5.07	5.38	6.33	5.90	6.65	6.69	6.91	5.40	6.40	5.03	4.93	4.47
27 ..	5.03	5.46	5.98	5.85	6.28	6.70	6.70	5.93	5.62	4.95	4.80	4.42
28 ..	5.00	5.78	6.08	5.75	5.95	6.80	6.47	5.41	5.43	4.85	4.38	4.37
29 ..	4.94	5.63	7.98	5.90	5.75	7.25	6.30	5.30	5.20	5.13	4.76	5.40
30 ..	4.90	5.43	8.83	7.16	.....	6.71	6.04	5.40	5.00	4.92	4.64	6.40
31 ..	4.80	.....	7.23	6.60	.....	6.50	.....	6.10	.....	4.73	4.67	.....

Williams River.

Williams River heads against Day Mountain, Pocahontas County, three miles northwest of Marlinton, the elevation of its source being 4300 feet above sea-level. It flows northwestward into Webster, having an elevation of 2753 feet at the county line and empties into Gauley River three miles southeast of Cowen, at an elevation of 2260 feet, making a total drop of 2040 feet from head to mouth. Its total length, from head to mouth, is 33.6 miles, that portion in Webster County being 17.6 miles. The area of its drainage basin is 130.63 square miles, almost all of which is covered with a dense and mostly virgin forest growth, there being only a few families living on its watershed. Through Webster the river

is a swift and shallow stream, with no recent meanders and only occasional short stretches of bottom land. The principal tributaries in Pocahontas are Little Laurel Creek, Laurel Creek, Sugar Creek, Tea Creek, and Hateful Creek. In Webster it is mainly fed by Middle Fork, Little Fork, Whiteoak Fork, Sawyer Run, and Craig Run. A comparison of the area of Williams River with that of Gauley above the mouth of the former stream reveals the fact that the Williams drainage basin is the greater and shows that it should have been classed as the parent stream by its early explorers.

Cranberry River.

Cranberry River, the most southern drainage basin of Webster, heads in Pocahontas against the Cranberry and Black Mountains, six miles west of Marlinton, the elevation of its source being 4600 feet. It flows northwestward into Webster, crossing the county line at an elevation of 2985 feet, and continues with the same general course for ten miles farther after which it veers to the southwest, crossing into Nicholas at an elevation of 2210 feet, and empties into the Gauley at Cranberry Station, its elevation at that point being 1920 feet, making a total drop of 2680 feet. Its total length from head to mouth is 32 miles, that portion in Webster being 13.2 miles. The area of its drainage basin is 74.08 square miles. Almost its entire watershed is covered with forest, most of which has been cut over in recent years. Throughout most of its length it is a swift and shallow stream, with steep mountains on either side, and only a few short stretches of bottom land. Its principal tributaries are North Fork, Dogway Fork, and Barrenshe Run.

Birch River.

Birch River rises in Webster just northwest of Cowen, flows northwestward across the northern edge of Nicholas and empties into Elk River at Glendon, Braxton County. Its total length from head to mouth is 38.6 miles, of which 12.4 miles are in Webster, 9.5 miles in Nicholas and 16.7 miles in Braxton. The elevation at its source is 2550 feet,

PLATE IV.—Salt Sulphur Well at Webster Springs, with boulders of Greenbrier Limestone (in place) just back of pavilion; Topography of Pottsville Series in background.

at the Webster-Nicholas line, 1255 feet, at the Nicholas-Braxton line, 980 feet, and at Glendon, 775 feet, making a total fall of 1775 feet from head to mouth. The area of its entire drainage basin is 140.60 square miles and of that portion above and including Skyles Creek, 26.60 square miles. Through most of its course it is a swift, shallow stream, flowing between steep slopes and having only narrow bottom lands and no recent meanders. Wide meanders inherited from the time of the Cretaceous Peneplain are very numerous. Its principal tributary in Webster County is Skyles Creek.

TOPOGRAPHIC FEATURES.

In its general features the topography of Webster differs little from that of other counties in the central portion of the State. There is a constant succession of deep river valleys and numerous tributary streams that have cut into the old Cretaceous Peneplain until only ridges remain. North of Elk River the work of degradation is more advanced since both V-shaped and U-shaped valleys may be found and the ridges are extremely sharp and are being rapidly weathered at their summits. The slopes are very steep, varying usually from 15 to 40 degrees, the present stream levels being 500 to 1000 feet below the summits of the ridges. South of Elk River degradation is less advanced. The valleys almost without exception are V-shaped and many of the ridges have wide flat tops indicating that considerable time must elapse before active weathering of their crests can begin. The valleys vary from 1000 to 2000 feet in depth and the slopes are very steep, often reaching 30 degrees.

An exception to the general topographic forms is noticeable in the vicinity of Cowen where certain sandstones have arrested stream erosion to such an extent that wide glades have been formed.

Owing to the absence of violent orogenic disturbance there are no prominent mountain scarps such as may be seen in Randolph and other neighboring counties where the uplifts have been more severe. The slopes in the main are symmetrical, their regularity of form and outline often causing their

height to be much underestimated when depending on the eye alone.

A marked feature in the central portion of the county is the great difference of elevation that exists between the neighboring valleys of Elk and Gauley Rivers, caused by the more rapid cutting of the former stream through the soft red shales of the Mauch Chunk Series into which it has found its way. The elevation of Elk at Webster Springs is 1440 feet and the level of the Gauley at Bolair, three miles distant, is 2260 feet, making a total difference of 820 feet. The Gauley waters could readily be diverted into Elk in this region, thus yielding enormous hydro-electric energy. Also in the not distant future, Elk River will cut away the narrow divide now separating it from the Gauley and capture the latter stream.

RIVER TERRACES.

River terraces were noted at infrequent points. On Left Fork of Holly River, terrace deposits were found in the low gap just east of Potato Knob, 3½ miles east of Hacker Valley, at an elevation of 1875 feet above sea-level and 100 feet above the level of Holly River. The following were noted along Elk River:

Terrace Deposits on Elk River.

Locality	Tidal elevation. Top	Height of top above drainage
Long point southwest of Tracy Switch	1500B	310
Webster Springs, at cemetery	1630L	190
Low gap just west of Mill Run	1850B	175
Valley Fork, 1 mile south of	2460B	160

The latter three localities seem to be at the same erosion level and apparently correspond with a terrace noted by Hennen[1] at the town of Sutton, Braxton County, at a height of 200 feet above the level of Elk, there being a gradual increase of the height above stream level in descending the river.

On the Back Fork of Elk River there is an apparent erosion level in the low gap immediately west of Skelt where the highway passes across to Right Fork of Holly River, the elevation of the gap being 2305 feet and its height above Back Fork, 405 feet.

On the Gauley no distinct terraces were observed. In the vicinity of Cowen there are numerous white clay deposits near the watershed between Big Ditch Run of Gauley and Laurel Creek of Elk, which may possibly represent an old erosion level of Gauley although they more closely resemble residual deposits.

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[1]Ray V. Hennen, Braxton-Clay Report, W. Va. Geol. Survey, p 22; 1917.

PART II.

Geology.

CHAPTER III.

STRUCTURE.

METHOD OF REPRESENTING STRUCTURE.

The contour method of representing structure has been used in this Report. By this method the pitch or dip of the rock strata over a given area is shown by determining the elevation of a single coal bed or other easily recognized stratum at frequent points and by connecting points of equal elevation with contour lines. When the area in question is covered with a succession of these lines, each representing a different stage of elevation, by a uniform interval, a complete map of the exact lay of the coal bed or other key-rock is obtained. At any given point on the map, stratified deposits, like those of Webster County, are closely parallel, and as the interval between all strata may be closely measured at different points it is possible to determine with practical accuracy the elevation of any coal bed or other desired stratum from the contours shown for the key-rock. This method of representation is ideal for a region in which the dip of the rocks is gentle and free from faults or violent upheavals and as these conditions prevail in Webster County, the structure contour map answers the purpose in full without resort to graphic cross-sections.

In Webster there is a somewhat rapid and only slightly interrupted southeastward rise of the rocks that causes the Lower Kittanning, Stockton, and other large coal beds of the northwestern part to overshoot the mountains in the vicinity of Webster Springs, and which brings above drainage the Sewell and other coals of the New River Group. Because of

this complete change of outcropping deposits it was not found practical to use the same key-rock over the entire county. On Map II, which accompanies this Report and shows the structure of the rocks, the **Eagle Coal** of the Kanawha Group has been used as the key-rock for the northwestern half of the county. This coal crops over almost the entire Holly River drainage as well as on Elk between Webster Springs and Centralia and on Laurel Creek, making it possible to determine elevations direct on this stratum at many points. In localities where it did not crop or where no openings were available its position was computed from other beds above or below it whose intervals from it at near-by points were carefully obtained. The contours on the Eagle Coal are shown on Map II by **green lines** at successive 50-foot intervals except along the axes of anticlines and synclines where intermediate 25-foot contours are employed to give more detail. It will be noted from the map that the Eagle (green) contours end with the 2300-foot level, which starts near Allingdale and passes roughly northeast, approximately through Upper Glade, intersecting Elk River one mile below Skidmore Crossing, and going about one-third mile west of Skelt, finally reaches the Webster-Randolph line at a point one mile and a half southeast of the common corner of those two counties with Upshur.

In the southeastern portion of the county, embracing all its territory not outlined above, as well as the strip of Randolph described in this Report, the **Sewell Coal** of the New River Group was used for the contoured stratum, since it is by far the most persistent and most easily recognized coal of that region. In distinction from the Eagle, the Sewell contours are shown by **red lines**, the same contour intervals of 50 feet on slopes and 25 feet along the axes of anticlines and synclines being employed. It will be noted on the map that the shift from green to red contours reveals the fact that the interval between the two coals is not constant along the line of shifting, there being a gradual increase from northeast to southwest. This fact made it necessary to insert several short red contours in passing toward the region of greater interval.

The detailed work necessary to prepare the structure map included several thousand observations on the key-rocks and other known stratigraphic horizons. Elevations were obtained mainly by the use of the aneroid, checked on the nearest government spirit-level determination as recorded on the topographic maps. In many cases it was possible to make hand-level measurements directly to the mines and prospects, thus reducing the possible error. Experience in other counties has proved that levels obtained by the aneroid when checked on the topographic base maps are seldom as much as 25 feet in error being often within 5 or 10 feet of the truth, and it is believed that the map of Webster will generally come within these limits.

There is a considerable variation in interval between the different stratigraphic horizons, due mostly to a fairly constant thickening of the measures to the south and southwest. In order that this fact might not interfere with the accuracy of the structure map or destroy its purpose, numerous detailed stratigraphic cross-sections and special measurements of intervals from place to place were made. The principal results of these many observations are condensed in the two following tables, the first of which shows intervals above and below the Eagle Coal and the latter of which shows intervals above and below the Sewell Coal. These tables have been used in determining contours on the key-rocks in localities where direct observations could not be obtained. Their use in conjunction with the additional data presented in Chapter IV is recommended for those who prospect further for the various coals. Several columns in each table show vacant spaces either because the members named at the left belong above the tops of the ridges or because they lie below drainage and there are no present data to show the information called for. In order to find the approximate elevation of any coal, its interval from the Eagle or Sewell Coal, as the case may be, should first be obtained from one of the tables or from the local measured section for the nearest point. Having the structure contours as a guide the coal should then be easily found.

Intervals Above and Below Eagle Coal, Webster County.

Formation	Bergoo	Camden-on-Gauley	Centralia	Cleveland	Cowen	Diana	Dogway	Dyer	Erbacon	Hacker Valley	Jumbo	Skelt	Skyles	Three Forks of Gauley	Waneta	Webster Springs
Upper Freeport Coal	....	840	840	725	775	825	....	....	750	750	775	....	835	....	....	....
Lower Freeport Coal	....	765	760	660	700	750	....	....	675	675	675	....	775	....	....	....
Upper Kittanning Coal	....	715	710	595	650	700	....	....	625	625	625	650	705	....	....	....
Middle Kittanning Coal	....	640	640	520	600	600	....	....	550	580	585	575	615	....	....	....
Lower Kittanning (No. 5 Block) Coal	....	590	590	465	550	550	....	....	500	550	565	550	575	....	....	....
Clarion Coal	....	560	590	465	530	525	....	....	450	530	....	500	....	....	....	....
Homewood Sandstone, top	....	555	590	465	525	515	....	....	450	525	565	490	570	....	....	....
Upper Mercer Coal	....	480	500	365	450	440	....	....	370	445	470	420	485	....	....	....
Kanawha Black Flint	....	440	420	290	415	405	....	....	335	365	430	385	415	....	....	....
Stockton Coal	....	435	415	285	410	400	....	....	330	360	425	380	410	....	....	....
Coalburg Coal	....	365	375	260	370	360	....	....	290	320	380	350	370	....	....	....
Little Coalburg Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Winifrede Coal	....	295	340	....	310	255	....	....	230	280	275	300	310	....	....	....
Chilton "A" Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Chilton Coal	....	260	315	....	260	225	....	....	210	250	250	250	240	....	....	....
Little Chilton Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Hernshaw Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dingess Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dingess Limestone	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Williamson Coal	....	....	250	....	....	....	....	....	....	....	....	....	....	....	....	....
Cedar Grove Coal	....	200	225	....	200	200	....	....	190	225	225	220	200	....	....	....
Lower Cedar Grove Coal	....	....	....	....	....	185	....	....	....	....	....	....	....	....	....	....
Alma "A" Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Alma Coal	....	160	160	....	160	165	....	....	160	170	....	165	175	....	....	....
Little Alma Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Campbell Creek (Peerless) Coal	....	125	125	....	125	125	....	....	100	125	110	140	135	....	135	....
Campbell Creek (No. 2 Gas) Coal	....	100	100	....	100	100	....	....	80	100	90	100	100	....	100	....
Powellton "A" Coal	....	40	40	....	40	40	....	....	40	40	40	40	50	....	50	....
Powellton Coal	....	30	30	....	30	30	....	....	30	30	30	30	40	....	40	....
EAGLE COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Little Eagle Coal	30	70	20	....	50	40	50	40	....	....	40	35	30	30	20	40

Intervals Above and Below Eagle Coal, Webster County—(Continued).

Formation	Bergoo	Camden-on-Gauley	Centralia	Cleveland	Cowen	Diana	Dogway	Dyer	Erbacon	Hacker Valley	Jumbo	Skelt	Skyles	Three Forks of Gauley	Waneta	Webster Springs
Cedar Coal	50	80	60	....	70	100	70	100	....	....	125	100	90	100	80	110
Eagle Limestone and Shale	75	90	70	....	90	110	90	110	....	....	165	110	100	110	90	130
Little Cedar Coal	90	90	75	....	125	115	150	120	....	....	....	120	110	120	100	150
Lower War Eagle Coal	100	115	80	....	150	120	165	130	....	....	165	130	120	150	105	160
Gilbert Coal	200	285	90	....	250	150	200	200	....	....	220	170	170	250	140	250
Douglas Coal	225	385	95	....	300	160	300	300	....	....	260	175	200	335	145	300
Lower Douglas Coal	240	405	95	....	350	165	400	330	....	....	270	185	215	345	150	370
Upper Nuttall Sandstone, top	250	410	100	....	360	170	430	340	....	....	280	190	225	350	155	400
Lower Nuttall Sandstone, top	360	505	120	....	460	250	490	410	....	....	310	235	280	425	190	500
Hughes Ferry Coal	415	625	140	....	560	290	575	500	....	....	350	275	300	525	225	550
Lower Iaeger Coal	430	650	210	....	580	350	620	525	....	....	380	315	330	570	260	580
Castle Coal	465	700	260	....	600	380	690	600	....	....	430	350	380	600	300	610
Sewell "B" Coal	520	750	280	....	620	410	760	660	....	....	495	400	405	700	350	660
Sewell "A" Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Sewell Coal	550	805	300	....	650	440	800	700	....	....	510	450	430	750	400	700
Welch Coal	590	870	330	....	670	470	840	730	....	....	560	470	460	800	425	740
Raleigh Sandstone, base	630	940	430	....	700	540	900	790	....	....	670	550	530	880	500	825
Beckley Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Fire Creek Coal	....	970	....	....	....	....	980	....	....	....	....	....	....	....	....	875
Princeton Conglomerate, top	....	1055	....	....	....	....	1070	975	....	....	....	....	....	915	....	925
Terry Limestone	815	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Greenbrier Limestone, top	1600	1995	990	955	....	....	....	....	....	....	....	....	....	....	....	1700

Intervals Above and Below Sewell Coal, Webster County.

Formation	Bergoo	Camden-on-Gauley	Centralia	Cowen	Diana	Dogway	Dyer	Jumbo	Skelt	Skyles	Three Forks of Gauley	Waneta	Webster Springs	Slaty Fork
Homewood Sandstone, top	....	1360	890	1175	955	....	....	1075	940	1000	....	....	....	....
Upper Mercer Coal	....	1285	800	1100	880	....	....	980	870	915	....	....	....	....
Kanawha Black Flint	....	1245	720	1065	845	....	....	940	835	845	....	....	....	....
Stockton Coal	....	1240	715	1060	840	....	....	935	830	840	....	....	....	....
Coalburg Coal	....	1170	675	1020	800	....	....	890	800	800	....	....	....	....
Little Coalburg Coal	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Winifrede Coal	....	1100	640	960	695	....	....	785	750	740	....	....	....	....
Chilton "A" Coal	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Chilton Coal	....	1065	615	910	665	....	....	760	700	670	....	....	....	....
Little Chilton Coal	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Hernshaw Coal	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Dingess Coal	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Dingess Limestone	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Williamson Coal	....	1030	550	....	....	....	....	....	....	....	....	....	....	....
Cedar Grove Coal	....	1005	525	850	640	....	....	735	670	630	....	....	....	....
Lower Cedar Grove Coal	....	....	...	....	625	....	....	....	....	....	....	....	....	....
Alma "A" Coal	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Alma Coal	....	965	460	810	605	....	....	....	615	605	....	....	....	....
Little Alma Coal	....	....	...	....	....	....	....	....	....	....	....	....	....	....
Campbell Creek (Peerless) Coal	....	930	425	775	565	....	....	620	590	565	....	....	....	....
Campbell Creek (No. 2 Gas) Coal	....	905	400	750	540	....	....	600	550	530	....	....	....	....
Powellton "A" Coal	....	845	340	690	480	....	....	550	490	480	....	....	....	....
Powellton Coal	....	835	330	680	470	....	....	540	480	470	....	....	....	....
Eagle Coal	550	805	300	650	440	800	700	510	450	430	750	400	700	....
Little Eagle Coal	520	735	280	600	400	750	660	470	415	400	720	380	660	....
Cedar Coal	500	725	240	580	340	730	600	385	350	340	650	320	590	....
Eagle Limestone and Shale	475	715	230	560	330	710	590	345	340	330	640	310	570	....
Little Cedar Coal	460	715	225	525	325	650	580	....	330	320	620	300	550	....
Lower War Eagle Coal	450	690	220	500	320	635	570	345	320	310	600	295	540	....
Gilbert Coal	350	520	210	400	290	600	500	290	280	260	500	260	450	....
Douglas Coal	325	420	205	350	280	500	400	250	275	230	415	255	400	....
Lower Douglas Coal	310	400	205	300	275	400	370	240	265	215	405	250	330	....

Intervals Above and Below Sewell Coal, Webster County—(Continued).

Formation	Bergoo	Camden-on-Gauley	Centralia	Cowen	Diana	Dogway	Dyer	Jumbo	Skelt	Skyles	Three Forks of Gauley	Waneta	Webster Springs	Slaty Fork
Upper Nuttall Sandstone, top	300	395	200	290	270	370	360	230	260	205	400	245	300	....
Lower Nuttall Sandstone, top	190	300	180	190	190	310	290	200	215	150	325	210	200	....
Hughes Ferry Coal	135	180	160	90	150	225	200	160	175	130	225	175	150	....
Lower Iaeger Coal	120	155	90	70	90	180	175	130	135	100	180	140	120	....
Castle Coal	85	105	40	50	60	110	100	80	100	50	150	100	90	....
Sewell "B" Coal	30	55	20	30	30	40	40	15	50	25	50	50	40	....
Sewell "A" Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....
SEWELL COAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Welch Coal	40	65	30	20	30	40	30	50	20	30	50	25	40	....
Raleigh Sandstone, base	80	135	130	50	100	100	90	160	100	100	130	100	125	....
Beckley Coal	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Fire Creek Coal	....	165	....	....	....	180	....	....	....	....	....	....	175	175
Princeton Conglomerate, top	....	250	....	....	....	270	275	....	....	....	165	....	225	250
Terry Limestone	265	....	....	....	....	....	....	....	....	....	....	....	....	....
Greenbrier Limestone, top	1050	1190	690	....	....	....	....	....	....	....	....	1050	1000	1300

DETAILED STRUCTURE .

GENERAL FEATURES.

As shown by Map II the original level structure of Webster has been only slightly disturbed by upward or lateral movements, the dip of the rocks being gentle and usually perceptible only by careful levels from point to point. Its present status is mainly that of a long monocline showing a gradual southeastward rise of the rocks toward Randolph, Pocahontas, and Greenbrier, where distortion of the strata has been much more severe, interrupted by one slight anticline and its corresponding shallow syncline, both of which reach almost across the county in an approximate north and south direction. The lowest structural point shown on the map is at Wildcat, at the extreme northwestern corner, where the Eagle Coal horizon has a tidal elevation of 850 feet. The highest structural elevation in the county is at the extreme southern corner, near Dogway village, where the Sewell Coal has an elevation of 3550 feet. Inasmuch as the Eagle Coal in the Dogway region would belong about 800 feet above the Sewell, the position of its horizon would be at 4350 feet, making a total southeastward rise of 3500 feet in the structural level. In that portion of Randolph County shown on Map II, the structure contours record an elevation of 4300 feet for the Sewell Coal at Elk Mountain, making the stratigraphic level in that region 750 feet higher than at the southern point of Webster.

The structure map, on the whole, harmonizes closely with those previously issued for adjoining counties. In Braxton contours have been shown on the Upper Kittanning Coal, in Lewis they are based on the Pittsburgh, and in Upshur and that portion of Randolph north of Elk River and Valley Fork, the Lower Kittanning was used for the key-rock. When the proper intervals have been subtracted to reduce these various horizons to that of the Eagle, which is far below them all, no important discrepancies are found.

A considerable portion of the northern half of Webster

has been previously contoured by Taff and Brooks[1], the Lower Kittanning Coal having evidently been the key-rock although it was not given a definite name in the Buckhannon Folio of the United States Geological Survey where this work appears. The two folds shown in the present Report are not detailed on the early map of these authors, probably having escaped recognition partly because of the reconnaissance nature of the investigation, and partly because of the fact that the folds in question are found only in the extreme southern portion of the area contoured in this Folio, and failed to be noted. Aside from this discrepancy the structural relations shown on the two maps are much the same.

DESCRIPTION OF ANTICLINES AND SYNCLINES.

Webster Springs Anticline.

The Webster Springs Anticline, not previously described, originates on Hodam Creek, two miles south of Hacker Valley and near the village of Hodam, and extends southward across the county, its general bearing being South 8 degrees West. Its course is transverse to the main drainage channels, crossing Right Fork of Holly River at Jumbo, Grassy Creek 0.7 east of Orndoff, passing through Webster Springs from which it derives its name, and crossing Elk River one-half mile above the mouth of Back Fork. South of Elk it reaches Gauley at a point one mile east of Bolair, crosses Williams River one mile and a half east of Dyer, crosses Cranberry River one-half mile west of Mill Branch and finally intersects the Webster-Nicholas line at a point 0.6 mile northwest of the Hanging Rock which is the common corner of those two counties with Greenbrier. In Nicholas County it veers slightly westward and crosses North Fork of Cherry River near the point where the Nicholas-Greenbrier line intersects that stream, beyond which its course is unknown.

During most of its length in Webster this fold is lacking in symmetry, the dip of the rocks westward from its axis often exceeding 200 feet to the mile, while the pitch toward

[1]Joseph A. Taff and Alfred H. Brooks, Buckhannon Folio, No. 34, U. S. Geological Survey, 1896.

the east is often less than 100 feet to the mile. There are two distinct domes. One of these is situated one mile south of Hodam village and has a closure of fifty feet, its shape being oblong with the longer axis coincident with that of the anticline. At its summit the Eagle Coal has an elevation of 1950 feet. At Jumbo the anticline descends to a low saddle, the Eagle Coal having an elevation of slightly over 1900 feet. South of Jumbo along the arch there is a rapid rise of the strata for a distance of twelve miles to a point between Gauley and Williams Rivers where a second dome is located. This dome shows a closing contour of more than 75 feet, the Sewell Coal having an elevation of 2775 feet at its top. At the Williams River there is another low saddle, the elevation of the Sewell being less than 2700 feet. South of this point there is a steady rise at the rate of 60 feet per mile for seven miles to the Nicholas line where the Sewell has an elevation of 3125 feet.

At the northern end of the anticline the surface geology is that of the Allegheny Series and the Kanawha Group of the Pottsville Series, the former being present in the high mountain ridges. At Elk River the Kanawha and New River Groups of the Pottsville are both well up toward the summits of the mountains, the Mauch Chunk Red Shales and Greenbrier Limestone being exposed below them. On Gauley only the Kanawha and New River are exposed along the axis, but on Williams and Cranberry, in addition to these two groups, the Mauch Chunk is visible at the base of the mountains.

Kovan Syncline.

The Kovan Syncline, not previously described, is a shallow basin lying east of and approximately parallel to the Webster Springs Anticline, the greatest distance between the two being less than four miles while at some points it is only slightly over one mile. This syncline originates less than one mile east of Hodam village, passes southward, crossing Right Fork of Holly River 1.2 miles east of Jumbo, and reaching Grassy Creek 0.4 mile west of the post village of

Kovan, from which it derives its name. From Grassy Creek the course is nearly south for 7½ miles, Elk River being intersected two miles above Webster Springs. At a point two and one-half miles east of Bolair the basin veers sharply toward the east and so continues for two miles, crossing the meanders of Gauley three times. Near the mouth of Turkey Creek it turns again to the south, crosses Williams River just below the mouth of Whiteoak Fork, crosses Cranberry just above the mouth of Rough Run, and intersects the Webster-Greenbrier line at a point 1.5 miles southeast of the common corner of those two counties with Nicholas.

Throughout most of its length the basin is symmetrical about its axis, the rise of the rocks on either side being much the same. East of Jumbo where the axis crosses Holly River, there is a low canoe-shaped depression, the elevation of the Eagle Coal being only 1750 feet. South of this point there is a very rapid rise of the strata along the axis all the way to Gauley River where there is a high structural saddle, the Sewell having an elevation of 2550 feet, followed immediately by a long depression of more than five miles, the elevation of the Sewell between Gauley and Williams being less than 2525 feet. South of Williams the strata rise steadily along the axis all the way to Cranberry River, the Sewell at the latter stream having an elevation of 3025 feet, but remaining the same to the Webster-Greenbrier line.

At the northern end of the syncline the surface geology is that of the Allegheny Series and the Kanawha Group of the Pottsville, the former cropping in the hilltops. From Elk River southward to the Greenbrier line the Allegheny Series belongs above the summits of the mountains but both the Kanawha and New River Groups outcrop on all the drainage. On Elk the principal portion of the Mauch Chunk is above the river but the top of the Greenbrier Limestone is below the river level, having dipped under drainage just east of the crest of the Webster Springs Anticline. On Gauley, Williams, and Cranberry only the upper portion of the Mauch Chunk is exposed.

UNCONFORMITIES AND ABSENCE OF FAULTS.

So far as known there are no unconformities in the Conemaugh and Allegheny Series in Webster, but at the base of the Pottsville Series where the Pennsylvanian Rocks rest upon the red shales of the Mauch Chunk, there is a well-known unconformity of the kind that nearly always occurs when later deposits rest upon much older eroded formations. In all of the Pennsylvanian Rocks local thickening and thinning occurs frequently and in Webster there is a considerable northward convergence in the Pottsville Series.

No faults were observed anywhere in the county and the dip of the strata is everywhere too gentle to favor their occurrence.

CHAPTER IV.

STRATIGRAPHY—MEASURED SECTIONS.

INTRODUCTION.

The surface rocks of Webster embrace the Quaternary, Pennsylvanian, and Mississippian. The Devonian Rocks do not outcrop but they have been pierced by certain oil test wells, the records of some of which are available.

The following classification of the rocks available for study shows their succession in convenient form, arranged in descending order. The Permo-Carboniferous and the Monongahela Series of the Pennsylvanian are included at their proper positions but are not found in Webster County, having evidently been completely eroded during the long interval between the deposition of the lower groups of the Pennsylvanian and Quaternary. They are included in this classification because of their well-known occurrence in several adjoining counties on the north and northwest, and because of their probable existence in the Webster area many thousands of years ago:

Age	Period	Series
Quaternary	Recent.	
	Pleistocene.	
Paleozoic	Permo-Carboniferous	Dunkard (not found in Webster).
	Pennsylvanian	Monongahela (not found in Webster).
		Conemaugh (normally 500-600′ thick, only lower 100 feet found in Webster).
		Allegheny (250-300′).
		Pottsville (200-650′).
		Kanawha Group (500-950′)
		New River Group (200-650′)
	Mississippian	Mauch Chunk (500-1500′).
		Greenbrier Limestone (100-400′).
		Pocono Sandstones (400-500′).
	Devonian	Catskill (400-500′).
		Chemung (?).

PLATE V.—View of Webster Springs Hotel, looking South; Topography of Pottsville and Mauch Chunk Series in background.

The Quaternary Rocks are represented by clays, gravels, and sand beds, present in Webster along the river and creek bottoms, and by Pleistocene river-terrace deposits of scanty occurrence, occupying higher levels at a few infrequent points. These two types of recent material are shown on Map II under the general title of Alluvium. As agricultural soil they form a valuable economic resource of the county.

The Dunkard Series, generally recognized as a transitional stage and therefore classed as of Permo-Carboniferous Age, occurs in Upshur, Lewis, and Braxton Counties, all of which join Webster on the north and northwest, and was probably deposited over the latter county but has been entirely eroded, its disappearance being synchronous with the gradual uplift of the strata. The same statement is probably true of the Monongahela Series of the Pennsylvanian, which is known to have once covered an immensely greater area of the State than it now occupies. The Conemaugh Series, represented by about 600 feet of sediments in the counties adjoining on the north, has almost entirely disappeared from Webster, the basal portion of it, comprising about 100 feet of strata being present in the extreme northwestern corner of the county.

The rocks of the lower portion of the Pennsylvanian, embraced by the Allegheny Series and the Kanawha and New River Groups of the Pottsville, comprise the great bulk of the surface deposits. The entire Allegheny is found in a strip along the northwestern corner but gradually disappears along with the southeastward rise of the rocks, its place in the hills being occupied by the Kanawha and New River which come above drainage in succession.

Of the Mississippian Period, comprised by the Mauch Chunk, Greenbrier, and Pocono, only the two former series crop in Webster, the Mauch Chunk being found generally along the river valleys in the southeastern portion, while the Greenbrier is found only along certain portions of the deep valley of Elk River about and above Webster Springs.

Knowledge of the Upper Devonian Rocks is scanty, as they do not outcrop and their underground nature, as well as that of the Pocono Series of the Mississippian, is known

only through the records of certain widely separated oil well borings.

Numerous geologic cross-sections, consisting of careful hand-level or aneroid measurements of surface strata, often combined with records of oil or coal test borings, and showing the rock succession from the Conemaugh to the Upper Devonian, will be given in the following pages.

MEASURED SECTIONS, HACKER VALLEY DISTRICT.

Hacker Valley District occupies the northern portion of the county, its surface rocks ranging from the Conemaugh Series, through the Allegheny Series and the Kanawha Group of the Pottsville, and into the New River Group.

The following section, previously published by the Survey,[1] was measured with aneroid by R. M. Gawthrop, starting near the top of the mountain in Salt Lick District, Braxton, just north of Wildcat, and descending to the forks of the Little Kanawha River at that point, which is the extreme northwest corner of Webster County:

[1]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, p. 56; 1917.

Wildcat Section, Corner of Webster, Lewis and Braxton Counties.

		Thickness Feet	Total Feet	
Allegheny Series (195′)				
Concealed from L. E. Drummond Coal Prospect, Upper Kittanning		25	25	25′
Sandstone, partly concealed, Upper East Lynn		65	90	
Sandstone, coarse-grained, brown, full of pebbles, East Lynn		35	125	
Concealed		31	156	
Coal Prospect, concealed, Lower Kittanning (1290′ B.), (reported)		4	160	135′
Concealed		35	195	
Pottsville Series—Kanawha Group (320)				
Sandstone, massive, medium-grained, grayish-brown, hard 25′ Concealed 30 Sandstone, massive, hard, medium-grained, brownish-gray, micaceous 40	Homewood	95	290	
Shale, dark-gray, coal trace, Stockton "A"		2	292	
Concealed		8	300	
Sandstone, massive, brown, medium-grained, hard, micaceous		25	325	
Coal (10"), Stockton (1125′ B.)		1	326	166′
Shale, siliceous		1	327	
Concealed		18	345	
Sandstone, flaggy		10	355	
Concealed to bed of Little Kanawha River, 100 yards below Wildcat		160	515	189′

The following section, arranged in descending order, and made by the writer near Cleveland, was first published by the Survey in the Lewis and Gilmer Report[2], but owing to its bearing on the geology of Hacker Valley District, is herein republished in full. Certain revisions made by Ray V. Hennen during his studies on the neighboring area of Braxton, and accepted by the writer, are incorporated in the present text. As explained in the Lewis County Report, a careful hand-level section was first made from Cleveland northward up the mountain to the Upper Mahoning Sandstone which caps it, the measurement including the Upper Kittanning and

[2]D. B. Reger, Lewis and Gilmer Report, W. Va. Geol. Survey, p. 75; 1916.

Stockton "A" Coals. Afterward, another hand-level section was measured up to the same opening in the Upper Kittanning Coal, starting at the Upshur-Lewis line on Flat Run, one mile northwest of Cleveland. This section included the Middle and Lower Kittanning Coals and the Kanawha Black Flint horizon. By compiling the two measurements a section 775 feet long is obtained that includes all the important formations found in this locality. At the time the section was measured a careful search was made on both sides of the river for fossils at the Black Flint horizon by both Dr. Price and the writer, without success, but its place did not seem subject to much doubt, since its interval below the Lower Kittanning Coal is about the same as at Bablin, a few miles northward. During the field studies for Webster County these fossils were finally located by the writer at an old opening in the Stockton Coal along the Hacker Valley road 0.8 mile south of Cleveland, where its interval below the Lower Kittanning Coal is approximately 165 feet as compared to 175 in the section below.

The lower part of the section is the record of the Vandervort and Pickens No. 1 (2) oil well, drilled by Meade Bros., for the Haddix and Leading Creek Oil and Gas Company, and first published by Dr. White in Volume I(a) of the Survey[3]. By determining the rise of the rocks between two openings in the Lower Kittanning Coal on either side, the well mouth was found to be about 460 feet below this horizon:

[3]I. C. White, Vol. I(a), W. Va. Geol. Survey, p. 393; 1904.

Cleveland Section, Corner of Lewis, Upshur, and Webster Counties.

	Thickness Feet	Total Feet	
Conemaugh Series (100′)			
Sandstone, massive, gray, pebbly, capping knob, Upper Mahoning	60	60	
Fire clay along bench, Thornton	....	60	
Shale, gray, sandy	40	100	
Allegheny Series (260′)			
Shale, gray, sandy, with plant fossils and iron ore, Upper Freeport	15	115	115′
Sandstone, shaly, Upper Freeport	28	143	
Concealed in bench	22	165	
Sandstone, partly concealed in bluff, Lower Freeport	35	200	
Concealed	15	215	
Shale, gray, sandy, with plant fossils	11	226	
Coal 0′ 4″ / Shale, dark 0 7 / Coal 2 8 — (3′ 7″) Upper Kittanning (1780′ L.) (John Beverage mine, No. 20 on Map II)	4	230	115′
Sandstone, massive, pebbly, cliff rock, Upper East Lynn	30	295	
Concealed	9	304	
Coal blossom, Middle Kittanning	1	305	75′
Concealed	12	317	
Sandstone, massive, cliff rock, with numerous plant fossils at base, East Lynn	35	352	
Coal 3′ 8″ / Slate, black 1′ 0 / Coal 0 11 / Slate, black 0 1 / Coal, visible 2 8 — (8′ 4″) Lower Kittanning (1665′ B.) (Nimrod Lake Mine)	8	360	55′
Pottsville Series (845′)			
Steep slope, with massive sandstone, Homewood	90	450	
Coal opening, thickness concealed, not much found, Upper Mercer (Stockton "A") (1590′ L.)	.....	450	90′
Concealed in steep slope	85	535	
Fire clay spring, Kanawha Black Flint horizon	.....	535	85′
Concealed in bench	10	545	
Concealed in slope	45	590	
Sandstone, massive, cliff rock, Upper Winifrede	50	640	
Concealed	90	730	
Sandstone, massive, partly concealed, to Little Kanawha River, Cleveland	45	775	
Interval	45	820	
Continued by Record of Vandervort and Pickens No. 1 (2) Well (1220′ B.):			
Quicksand	25	845	
Sand, white, hard (conductor, 35′)	25	870	
Lime and slate	75	945	
Sand, hard and poor	33	978	
Lime	25	1003	

		Thickness Feet	Total Feet	
Shale and lime		89	1092	
Lime, sandy		93	1185	
Shale, white		20	1205	
Mauch Chunk Series (575′)				
Lime, sandy, shale and red rock		515	1720	1185′
Sand, Maxton?		25	1745	
Lime, sandy, Little Lime		25	1770	
Shale, black		10	1780	60′
Greenbrier Limestone (165′)				
Big Lime		165	1945	
Pocono Sandstones (425′)				
Sand (cave, 1200′; salt water, 1225′)	100′			
Sand and lime (cased, 6⅝″)	40	Big Injun	140	2085
Red rock		20	2105	
Lime, sandy		215	2320	540′
Sand, gray, Berea		50	2370	
Catskill Series (257′)				
Shells, sandy, and slate		50	2420	
Lime shells, and slate		100	2520	
Lime, sandy		50	2570	
Lime, shells and slate, to bottom		57	2627	

At the extreme northeastern corner of Webster, the following section was made with aneroid by D. D. Teets, Jr., starting at the triangulation point just south of the common corner with Upshur and Randolph, and working eastward down Devil Run to Arvondale Junction on Buckhannon River, having been previously published by the Survey[4]. Owing to the southeastward rise of the rocks the intervals are shorter than true vertical measurement would show. To the section as therein published is added the record of the **Mayton Lumber Company No. 4903 (13) well**, which was drilled by the Hope Natural Gas Company, having been completed November 30, 1917, and plugged and abandoned. According to levels by Teets the hole starts 35′ below the measured section. Its full record was published on pages 387-388 of the volume above mentioned:

[4]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, p. 180; 1918.

Arvondale Junction Section, Middle Fork District, Randolph County.

	Thickness Feet	Total Feet	
Allegheny Series (70′)			
Concealed	30	30	
Shale, sandy, and concealed	20	50	
Slate, black	3.5	53.5	
Coal, soft 1′ 3″ / Coal, bony and slaty 2 3 / Coal, soft 3 0 — (6′ 6″) Lower Kittanning (2730′ B.). (D. S. Thomas Mine No. 59 on Map II)	6.5	60	60
Shale and concealed	10	70	
Pottsville Series—Kanawha Group (612′)			
Sandstone, massive, pebbly, Homewood	20	90	
Shale and concealed	15	105	
Concealed, bench	5	110	
Shale, sandy, and concealed	40	150	
Bench, concealed	5	155	
Shale, sandy, and sandstone, Upper Connoquenessing, (Upper Coalburg?)	40	195	135
Shale, sandy, and concealed	40	235	
Sandstone	15	250	
Shale, sandy, and sandstone	15	265	
Sandstone, flaggy	15	280	
Shale, sandy, and concealed	35	315	
Concealed, bench	10	325	
Shale, sandy, and sandstone	40	365	
Concealed	10	375	
Sandstone	20	395	
Shale, sandy, and concealed	50	445	
Sandstone, massive, medium-grained	30	475	
Slate, dark, cannelly, with Lingula fossils near top, Newlon	12	487	292
Sandstone, to run (2300′ B.)	3	490	
Interval, (should contain Eagle Coal)	35	525	
Continued by Mayton Lumber Company No. 4903 (13) Well Record (2265′ B.):			
Sand, hard (water, 94′) Lower Gilbert and Dotson	150	675	
Lime, white, hard	7	682	
Pottsville Series—New River Group (453′)			
Sand, white, hard (10″ casing, 170′) 13′ / Sand, dark, hard 20 / Sand, white, hard (water, 210′) 160 — Upper and Lower Nuttall	193	875	
Slate, black	110	985	
Slate, dark, Sewell Coal horizon	10	995	508
Sand, gray, Rosedale Salt	140	1135	
Mauch Chunk Series (671′)			
Slate	20	1155	
Lime, gritty, (8¼″ casing, 670′)	55	1210	
Sand, gray	15	1225	
Slate, gray	50	1275	
Lime, gray	40	1315	
Slate, light	30	1345	

	Thickness Feet	Total Feet	
Lime, light	40	1385	
Gray (?)	40	1425	
Red rock	190	1615	
Lime, white	20	1635	640′
Sand, Maxton (?)	44	1679	
Slate and shells	78	1757	
Sand	14	1771	
Slate	12	1783	
Lime, Little	10	1793	
Slate, and shells	13	1806	171′
Greenbrier Limestone (60′)			
Big Lime	60	1866	
Pocono and Catskill Series (1134′)			
Sand, Big Injun	61	1927	
Unrecorded	673	2600	
Sand, gray (6⅝″ casing, 2081′) Fourth	16	2616	
Slate and shells	64	2680	874′
Sand, gray, Fifth	8	2688	
Slate and shells	232	2920	
Lime, white	80	3000	
Chemung and Portage Series (2474′)			
Sand, white, Warren First?	50	3050	
Slate and shells	858	3908	1228′
Sand, gray, Speechley (oil at 3393′)	27	3935	
Slate	325	4260	
Unrecorded	13	4273	
Sand, dark-gray	6	4279	
Slate and shells	14	4293	
Sand, gray, Sheffield?	14	4307	
Slate and shells	218	4525	
Slate, soft, black	275	4800	
Lime, gritty	35	4835	
Slate and shells	80	4915	
Slate	240	5155	
Slate and shells	295	5450	
Unrecorded to bottom of hole	24	5474	

In the well record above attention is called to the fact that thick beds of lime are not usually found in the Mauch Chunk, Pocono, Chemung, and Portage Series, and that with the exception of the Big Lime, which is a true calcareous horizon, the various members designated as "lime" by the driller should more properly have been called shale or slate.

The following section, previously published by the Survey[5], was measured with aneroid, starting at the sand quarry one-half mile southeast of Silica, and working westward to the Right Fork of Buckhannon River, the two McCauley mines which are located just north of the village being in-

[5]Ibid., p. 181; 1918.

serted at their proper geologic horizons. The section shows several coals the horizons of which were concealed in the Arvondale Section:

Silica Section, Middle Fork District, Randolph County.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (580′)			
Sandstone, massive, coarse, soft, pebbly, quarry rock, **Homewood**	40	40	
Concealed and shale	3	43	
Coal, soft, columnar, Upper Mercer (J. A. McCauley Mine) (3′ 4″)	3	46	46′
Concealed	24	70	
Sandstone, massive, **Upper Connoquenessing**	15	85	
Concealed	70	155	
Coal prospect, Quakertown, thickness concealed	.....	155	109′
Concealed	136	291	
Shale, sandy, dark	7	298	
Concealed	120	418	
Coal, splinty (2′ 2″) Campbell Creek, Peerless bench (R. T. McCauley Mine)	2	420	265′
Concealed	80	500	
Sandstone, massive, **Eagle**	60	560	
Shale, black, sandy, to river, **Newlon**	16	576	
Coal, reported in river, Eagle (2360′ B.)	4	580	160′

The following section, measured with hand-level and arranged in descending order, starts at the top of a high hill 0.6 mile north of Wheeler and extends southwestward to Left Fork of Holly River near a church:

Wheeler Section, Hacker Valley District.

	Thickness Feet	Total Feet	
Conemaugh Series (80′)			
Sandstone, massive, **Upper Mahoning**	30	30	
Concealed and sandy shale, **Uffington**	50	80	
Allegheny Series (260′)			
Sandstone, massive, **Upper Freeport**	45	125	
Concealed	38	163	
Sandstone, massive	27½	190½	
Coal blossom, Lower Freeport, (1950′ L.) reported	1½	192	192′
Concealed	22	214	
Coal blossom, at old prospect, Upper Kittanning (1928′ L.)	.....	214	22′
Sandstone, massive, **Upper East Lynn**	22	236	
Concealed and slate	44	280	

	Thickness Feet	Total Feet	
Coal ..... 3′ 2″ ⎫ (6′ 7″) Lower Kittan-			
Slate, black, ⎪ ning (1855′ L.) (Lloyd	7	287	73′
bony..... 0 6 ⎬ Anderson Mine No.			
Coal ..... 2 11 ⎭ 68 on Map II)			
Concealed and sandy shale.....	53	340	
Pottsville Series—Kanawha Group (492′)			
Sandstone, massive, **Homewood**.....	30	370	
Concealed	12	382	
Coal blossom, at old prospect, **Upper Mercer** (1760′ L.).....	.....	382	95′
Concealed	38	420	
Sandstone, massive.....	5	425	
Concealed, with sandstone.....	155	580	
Black slate, and **coal blossom, Cedar Grove?** (1562′ L.).....	.....	580	198′
Sandstone, massive, **Peerless**.....	33	613	
Concealed	19	632	
Slate, black, **Alma Coal horizon**.....	5	637	
Shale, sandy, partly concealed.....	38	675	
Sandstone, massive, gray, cliff rock, **Browns-town**	47	722	
Concealed, with black slate.....	77	799	
Sandstone, massive, **Eagle**.....	25	824	
Coal ..... 0′ 3″ ⎫ (2′ 7″) **Eagle Coal** (1315′			
Sandstone 0 4 ⎬ L.) May Duke Mine	3	827	247′
Coal, hard 2 0 ⎭ (No. 393 on Map II)			
Slate and concealed to Holly River.....	5	832	

The following section, measured principally with hand-level and arranged in descending order, starts at the top of the mountain one-half mile west of Pugh, and descends eastward to Left Fork of Holly River at that village:

Pugh Section, Hacker Valley District.

Allegheny Series (220′)	Thickness Feet	Total Feet	
Sandstone, massive, brown, coarse, **Lower Freeport**	65	65	
Concealed, with fire clay.....	35	100	
Coal blossom, Upper Kittanning (2050′ B.)	.....	100	100′
Fire clay, partly flinty and partly plastic, **Upper Kittanning**.....	10	110	
Concealed	25	135	
Sandstone, massive, **Upper East Lynn**.....	5	140	
Fire clay.....	.....	140	
Concealed, with **coal blossom, Middle Kittanning**	14	154	54′
Sandstone, massive, **East Lynn**.....	40	194	

		Thickness Feet	Total Feet	
Coal, medium-hard 1′ 2″ Slate, black 0 2 Coal, medium-hard 1 0 Coal, soft 0 10 Slate, black, bony 0 4 Coal, hard 1 2 Slate, black, soft 0 1 Coal, hard 1 6	(6′ 3″) Lower Kittanning (1950′ B.) (George Brake Mine) (No. 76 on Map II)	6	200	46′
Concealed		20	220	
Pottsville Series—Kanawha Group (480′)				
Sandstone, massive, Homewood		30	250	
Concealed		10	260	
Coal blossom, Upper Mercer (1880′ B.)		.....	260	60′
Concealed		75	335	
Fire clay, Stockton Coal horizon (1805′ B.)		.....	335	75′
Concealed		85	420	
Slate, dark, with Lingulae, Winifrede Limestone (1715′ B.)		5	425	90′
Sandstone, shaly, and shale		20	445	
Coal blossom, Chilton		.....	445	20′
Shale, sandy		25	470	
Sandstone, massive, concealed, and sandstone, massive, Peerless		35	505	
Slate, black, streak, Alma Coal horizon		.....	505	60′
Concealed		45	550	
Sandstone, Monitor, and concealed		25	575	
Coal blossom, Campbell Creek (Peerless bench) (1565′ B.)		.....	575	70′
Concealed		100	675	
Sandstone, massive, Eagle		15	690	
Coal opening, abandoned, Eagle (1450′ B.)		.....	690	115′
Concealed and sandstone to Holly River		10	700	

MEASURED SECTIONS, HOLLY DISTRICT.

Holly District occupies a belt of country stretching in an east and west direction entirely across the county, north of its center, and comprising portions of the Holly and Elk drainage. Its surface rocks range from the lower portion of the Conemaugh, through the Allegheny, both groups of the Pottsville and into the Mauch Chunk Reds.

The following section, measured by Ray V. Hennen and previously published by the Survey,[6] is located in Holly District, Braxton County, at the mouth of Holly River, four miles from the Webster line. It is republished herein be-

[6]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 97-98; 1917.

cause of its important bearing on the stratigraphy of the lower portion of Holly River, Mr. Hennen's descriptive remarks being as follows:

"The following section was measured with aneroid by the writer on the north hillside of Elk River at Palmer. That portion above the base of the Lower Kittanning Coal was determined southeastward from the summit of the knob, 0.6 mile northeast of Holly Junction, to the old abandoned mine in the latter bed, the details of which are published by I. C. White on page 522 of Volume II(A) of the State Geological Survey Reports, the openings being closed when visited during 1915[7]. That portion below the coal in question was measured southwestward along the point to just below the West Virginia Midland Railway Station at Palmer. The section is important, in that the interval between the Lower Kittanning and Stockton Coals is exhibited. It also shows the horizon of the marine fossiliferous Winifrede Limestone:"

[7]During the summer of 1917 this coal was reopened for commercial shipment by the Holly-Elk Coal Company (D. B. R.)

Palmer Section, Holly District, Braxton County.

		Thickness Feet	Total Feet	
Conemaugh Series (60′)				
Sandstone, coarse, brown, top flaggy, and medium-grained bottom, **Lower Mahoning**		50	50	
Concealed		10	60	60′
Allegheny Series (270′)				
Concealed in bench, **Upper Freeport Coal horizon**		15	75	
Sandstone, current-bedded, medium-grained, **Upper Freeport**		40	115	
Concealed, steep slope		25	140	
Concealed in flat bench, with iron ore, **Lower Freeport**		10	150	90′
Sandstone, current-bedded, medium-grained, grayish-white, forms cliff, **Lower Freeport**		60	210	
Shale, gray		1.7	211.7	
Coal, bony 1′ 0″	**Upper Kittanning**	3.3	215	65′
Coal, medium-soft 2 3				
Slate and concealed		10	225	
Sandstone, current-bedded, medium-grained, grayish-white, forms cliff, **Upper East Lynn**		60	285	
Shale, sandy, concealed and slate		25.5	310.5	
Coal, hard, bony 0′ 8″				
Slate, dark 0 5				
Coal, good 1 2	**Middle Kittanning**	4	314.5	
Coal, bony 0 3				
Coal, good, hard 1 4				
"Mother" coal 0 2				

	Thickness Feet	Total Feet	
Sandstone, fine-grained, hard, East Lynn	2.5	317	
Coal, hard 2′ 0″ / Shale, gray 3 0 / Coal, softer 3 0 } Lower Kittanning (1125′ B.)	8	325	
Shale, sandy	5	330	115′
Pottsville Series—Kanawha Group (285′)			
Sandstone, grayish-white, medium-grained, makes cliff, Homewood	100	430	
Concealed	33	463	
Shale, sandy, buff	7	470	
Shale, dark, plant fossils, Kanawha Black Flint horizon?; no marine fossils seen	1.5	471.5	
Coal, gas 0′ 6″ / Coal, slaty 1 4 / Coal, medium-hard 1 8 } Stockton	3.5	475	145′
Slate and concealed	70	545	
Sandstone	5	550	
Shale, sandy	14	564	
Shale, black, with marine fossil shells abundant, Winifrede Limestone horizon	6	570	
Shale, sandy, bluish-gray	4.3	574.3	
Coal, Chilton?	0.7	575	100′
Shale	2	577	
Sandstone, to W. Va. Midland R. R. grade, Palmer Station	13	590	
Concealed to bed of Elk River	25	615	40′

The following section, previously published by the Survey[8], was measured with aneroid by Ray V. Hennen, down the hillside south of Holly River[9], one-fourth mile southwest of Holly Station, the intervals being larger than true vertical measurement would show, owing to the northwest dip of the rocks:

[8]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 99-100; 1917.

[9]In the publication above referred to the name "Elk River" was erroneously used instead of Holly River, in the description of this section. (D. B. R.)

Holly Section, Holly District, Braxton County.

	Thickness Feet	Total Feet	
Conemaugh Series (60′)			
Sandstone, grayish-white, conglomeratic, large white quartz pebbles, some 1 inch in diameter, **Lower Mahoning**	60	60	60′
Allegheny Series (290′)			
Bench, **Upper Freeport Coal horizon**	10	70	
Concealed, mostly sandstone in steep slope	75	145	
Bench	5	150	
Concealed, steep slope	105	255	
Sandstone, grayish-white, coarse, platy, **East Lynn**	35	290	
Concealed, steep slope	35	325	
Concealed, bench, and shale, with black slate	25	350	290′
Pottsville Series (310′)			
Sandstone, grayish-white, platy, making great cliff, **Homewood**	80	430	
Concealed	10	440	
Sandstone, platy, making cliff	25	465	
Concealed	10	475	
Sandstone, current-bedded, making great cliff, medium-grained, grayish-brown	25	500	
Concealed	5	505	
Coal digging, Stockton, reported	5	510	160′
Concealed, steep slope	25	535	
Coal blossom and black slate, Coalburg	5	540	
Sandstone, platy	30	570	
Bench	10	580	
Concealed (980′ B.)	80	660	150′

The following section, previously published by the Survey[10], but being of much interest in Webster County, was measured with aneroid by R. M. Gawthrop down the hill road on the north side of Left Fork of Holly River at Marpleton. At its proper horizon Mr. Hennen has inserted a coal which he terms locally the "**Marpleton**" and which he has doubtfully referred to the Cedar Grove horizon. This coal the writer has later identified with the Peerless Bench of the Campbell Creek Coal, since it is found at numerous points on Right Fork of Holly River at an interval of about 125 feet above the true Eagle Coal, the same interval being noted with little variation from Fickens, Randolph County, southwestward across Webster and Nicholas to the mouth of the Gauley River in Fayette County where its identification is not sub-

[10]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, p. 100; 1917.

ject to further doubt. The Marpleton Section, published below, does not show the Eagle Coal but as this horizon on Holly River lies at an interval of 400 feet below the Stockton Coal, with little variation, and comes above drainage on Left Fork of Holly less than one-half mile above Marpleton the correlation of the Marpleton seam with the Peerless appears certain. In the section as published below, the intervals are slightly less than true vertical measurement would show, owing to the northwestward dip of the rocks:

Marpleton Section, Holly District, Braxton County.

	Thickness Feet	Total Feet	
Allegheny Series (220′)			
Concealed from top of knob	80	80	
Sandstone and concealed	50	130	
Sandstone, massive, current-bedded, Upper East Lynn	20	150	
Concealed	70	220	220′
Pottsville Series—Kanawha Group (505′)			
Sandstone, Homewood	10	230	
Concealed	95	325	
Shale, gray, sandy	5	330	
Coal, weathered slaty 1′ 6″ / Coal 1 6 — Stockton	3	333	113′
Shale and concealed	17	350	
Sandstone	15	365	
Concealed	229	594	
Shale, gray, plant fossils	5	599	
Coal, gas 1′ 0″ / Shale, gray 4 0 / Coal, cannally, thickness concealed, estimated 2 0 — "Marpleton" (Cedar Grove?) Peerless Bench of Campbell Creek	6	605	272′
Concealed to road fork at Marpleton (974′ L.)	120	725	120′

The following section was measured with aneroid, starting at the top of a high knob, 0.8 mile northeast of Big Run Station, and descending westward to Right Fork of Holly River. The westward dip of the strata makes the intervals appear slightly greater than true vertical measurement would show:

Big Run Section, Holly District.

	Thickness Feet	Total Feet	
Allegheny Series (105′)			
Sandstone, massive, pebbly, capping knob, Upper East Lynn	15	15	
Shale, sandy	20	35	
Coal blossom, Middle Kittanning (2040′ B.)	.....	35	35′
Concealed and fire clay	15	50	
Sandstone, massive, cliff rock, East Lynn	35	85	
Concealed, Lower Kittanning Coal horizon	20	105	70′
Pottsville Series—Kanawha Group (760′)			
Sandstone, massive, cliff, partly concealed, Homewood	125	230	
Concealed	20	250	
Coal blossom, Stockton (1825′ B.)	.....	250	145′
Concealed and sandy shale	49	299	
Coal 2′ 0″ / Shale, gray 1 6 / Coal 2 10 — (6′ 4″) Coalburg (1770′ B.) (R. F. Tanner Prospect) (No. 212A on Map II)	6	305	55′
Concealed	20	325	
Coal blossom, Winifrede (1750′ B.)	.....	325	20′
Concealed, with sandy shale	150	475	
Sandstone, shaly	5	480	
Concealed	75	555	
Sandstone, massive, Peerless	6	561	
Shale, gray, (0′ 10″)	1	562	
Coal, cannel (3′ 0″) Campbell Creek (Peerless bench) (1510′ B.) (R. F. Tanner Mine) (No. 295 on Map II)	3	565	240′
Concealed	121	686	
Coal, Eagle, supplied from opposite hill	4	690	125′
Concealed	175	865	
Pottsville Series—New River Group (105′)			
Concealed	40	905	
Sandstone, Upper Nuttall, and concealed	65	970	
Sandstone, massive, in bed of Holly River, Lower Nuttall (1105′ B.)	.....	970	

The following section, measured principally with hand-level, and arranged in descending order, starts at the top of a high knob, 0.7 mile southeast of Diana, and continues northwestward to Right Fork of Holly River at that village. That portion of the section below and including the Eagle Shale was secured immediately north of the railroad station:

PLATE VI.—Oakland Hotel at Webster Springs.

Diana Section, Holly District.

	Thickness Feet	Total Feet	
Allegheny Series (205')			
Sandstone, flaggy, Lower Freeport, capping knob	30	30	
Concealed in slope	50	80	
Sandstone, partly concealed in slope, Upper East Lynn and East Lynn	105	185	
Concealed in bench, Lower Kittanning Coal horizon	20	205	205'
Pottsville Series—Kanawha Group (800')			
Concealed in steep bluff, contains Homewood Sandstone	111	316	
Coal, soft 2' 5" / Coal, hard, splinty 0 6 / Coal, soft 1 5 — (4' 4") Stockton (1930' B.) Tanner & Cutlip Mine (No. 184 on Map II)	4	320	115'
Concealed	365	685	
Slate, black, thickness concealed, (Powellton Coal horizon)	.....	685	
Concealed	10	695	
Sandstone, massive, cliff rock, Eagle	25	720	
Bench, Eagle Coal horizon (1530' B.)	.....	720	400'
Concealed, with sandy shale	110	830	
Sandstone, massive, cliff, Grapevine?	20	850	
Shale, dark, fossiliferous (?) Eagle	15	865	
Coal blossom, Lower War Eagle (1385' B.)	.....	865	145'
Sandstone, shaly	5	870	
Shale, dark, sandy	30	900	
Sandstone, massive, great cliff, to Holly River, Lower Gilbert	105	1005	

In the following section the surface portion was measured with hand-level, and as arranged in descending order, starts at the top of the Hodam Mountain, 1.6 miles northward from Jumbo, and extends southward along the strike of the measures to Right Fork of Holly River at that village. The lower portion is the record of the John T. McGraw No. 1 Coal Test Boring (6), located in the valley at the foot of the measured section, the details having been furnished by Col. John T. McGraw, of Grafton, who had the hole drilled. The combined section reveals the entire Pottsville, as well as a considerable portion of the Allegheny:

Jumbo Section, Holly District.

	Thickness Ft.	In.	Total Ft.	In.	
Allegheny Series (197′)					
Sandstone, massive, Upper Freeport	25	0	25	0	
Concealed	25	0	50	0	
Sandstone, massive, pebbly, Lower Freeport	25	0	75	0	
Concealed to low gap	32	0	107	0	
Sandstone and shale	14	0	121	0	
Coal 0′ 5″ / Slate, black, bony 0 5 / Coal 1 0 — (1′ 10″) Upper Kittanning (2542′ L.) (Mine No. 24 on Map II)	2	0	123	0	123′
Concealed	9	0	132	0	
Fire clay, flinty, Upper Kittanning	2	0	134	0	
Sandstone, massive, Upper East Lynn	30	0	164	0	
Concealed	3	0	167	0	
Coal blossom, (prospected but not much found) Middle Kittanning (2497′ L.) about	1	0	168	0	45′
Fire clay shale	2	0	170	0	
Sandstone, massive, East Lynn	13	0	183	0	
Concealed	12	0	195	0	
Coal opening, abandoned, Lower Kittanning (2468′ L.) blossom shows	2	0	197	0	29′
Pottsville Series—Kanawha Group (833′)					
Sandstone, massive, Homewood	70	0	267	0	
Concealed, with sandstone	68	0	335	0	
Coal blossom, Stockton (2330′ L.)	.....		335	0	138′
Concealed and sandstone, massive, Upper Coalburg	42	0	377	0	
Concealed	26	0	403	0	
Shale, dark and sandy, partly concealed	17	0	420	0	
Concealed in steep bank, mostly sandstone, Upper Winifrede	65	0	485	0	
Coal blossom, Winifrede (2180′ L.)	.....		485	0	159′
Shale, sandy, with sandstone, Upper Chilton	25	0	510	0	
Coal, medium-soft, (2′ 8″) Chilton, (2152′ L.) (Mine No. 241 on Map II)	3	0	513	0	28′
Fire clay and concealed	2	0	515	0	
Sandstone, massive, partly concealed, Lower Chilton	50	0	565	0	
Shale, sandy and dark, partly concealed	70	0	635	0	
Slate, black, Campbell Creek Coal horizon	14	0	649	0	136′

	Thickness Ft.	In.	Total Ft.	In.	
Shale, sandy, ferruginous	2	0	651	0	
Sandstone, shaly on top, massive at base, **Brownstown**	45	0	696	0	
Concealed, with sandy shale	65	0	761	0	
Coal prospect, fallen shut, Eagle (1904′ L.)	.....	..	761	0	112′
Concealed	38	0	799	0	
Coal blossom, Little Eagle (1866′ L.)	.....	..	799	0	
Concealed	78	0	877	0	
Slate, black, partly concealed	9	0	886	0	
Coal (1′ 0″) Cedar (1778′ L.)	1	0	887	0	126′
Shale, sandy, concealed, and dark shale, **Eagle**	38	0	925	0	
Coal blossom, Lower War Eagle (1740′ L.)	.....	..	925	0	38′
Fire clay and sandy shale	6	0	931	0	
Concealed	89	0	1020	0	
Slate, black, **Gilbert Coal horizon (?)**	10	0	1030	0	
Pottsville Series—New River Group (398′ 8″)					
Concealed	45	0	1075	0	
Slate, black, with sulphur spring	3	0	1078	0	
Sandstone, massive, **Lower Nuttall**	15	0	1093	0	
Slate, black, with ferruginous nodules	15	0	1108	0	
Sandstone, hard, jimy (0′ 4″)	.....	..	1108	0	
Coal, (0′ 8″) Hughes Ferry (1556′ L.)	1	0	1109	0	184′
Fire clay and black slate to bore hole	16	0	1125	0	
Continued by John T. McGraw No. 1 Coal Test Record (6) (1540′ L.):					
Casing	6	6	1131	6	
Sandstone	2	0	1133	6	
Shale, dark	5	0	1138	6	
Coal, Lower Iaeger	0	2	1138	8	29′ 8″
Shale, dark, with sandstone partings	75	0	1213	8	
Shale, dark	25	4	1239	0	
Shale, blue	2	0	1241	0	
Shale, dark	16	0	1257	0	
Coal, Sewell "B"	0	4	1257	4	118′ 8″
Slate	0	2	1257	6	
Shale, dark	13	6	1271	0	
Coal 0′ 6″ / Slate 0 2 / **Coal** 0 4 — **Sewell**	1	0	1272	0	14′ 8″
Shale, dark	15	3	1287	3	
Shale, dark, with coal partings	2	9	1290	0	
Shale, dark	31	0	1321	0	
Bone coal, Welch ?	0	2	1321	2	49′ 2″
Lime shale	9	0	1330	2	
Sandy shale, dark	29	0	1359	2	

	Thickness Ft.	In.	Total Ft.	In.
Sandstone	7	6	1366	8
Shale, dark, with sandstone partings	20	0	1386	8
Sandstone, Upper Raleigh (Sharon)	42	0	1428	8
Mauch Chunk Series (367′ 4″)				
Shale, dark	73	0	1501	8
Shale, blue	25	4	1527	0
Shale, light blue	10	0	1537	0
Shale, red	4	0	1541	0
Shale, light blue	2	0	1543	0
Shale, red	2	0	1545	0
Shale, light blue	5	0	1550	0
Shale, red	4	0	1554	0
Shale, light blue	8	0	1562	0
Sand shale, dark	34	0	1596	0
Shale, black	1	0	1597	0
Sand shale, light	19	0	1616	0
Shale, red	1	4	1617	4
Shale, light blue	0	8	1618	0
Shale, red	5	0	1623	0
Shale, light blue	2	6	1625	6
Shale, red	46	0	1671	6
Sand shale, light	2	0	1673	6
Shale, red	2	6	1676	0
Sand shale, light	6	6	1682	6
Shale, spotted or conglomerate	2	6	1685	0
Shale, red	8	0	1693	0
Shale, light blue	3	3	1696	3
Shale, red	19	0	1715	3
Sand shale, light	34	0	1749	3
Shale, spotted or conglomerate	2	0	1751	3
Shale, red	23	6	1774	9
Sand shale, light	8	3	1783	0
Shale, red, to bottom	13	0	1796	0

The following section, measured with aneroid and arranged in descending order, starts at the top of a high knob south of the mouth of Laurel Fork of Right Fork of Holly River, and 2.2 miles southeast of Jumbo, and ends at the mouth of the fork. Mr. M. P. Brooks, who once thoroughly prospected this mountain for coal, is authority for thicknesses where the openings had fallen shut:

Laurel Fork of Holly Section, Holly District.

	Thickness Feet	Total Feet	
Allegheny Series (260′)			
Concealed from top of knob	20	20	
Sandstone, massive, **Upper Freeport**	30	50	
Concealed	48	98	
Coal, Upper Kittanning, (2515′ B.) reported	2	100	100′
Sandstone, massive, **East Lynn**	70	170	
Concealed	21	191	
Coal blossom, thickness unknown; Soapstone 1′ 2″; **Coal,** blocky, reported 3 0 — (4′ 2″) **Lower Kittanning** (2420′ B.) M. P. Brooks Mine (No. 93 on Map II)	4	195	95′
Concealed	65	260	
Coal blossom, Clarion? (2355′ B.)	.....	260	65′
Pottsville Series—Kanawha Group (520′)			
Concealed	39	299	
Coal, (2315′ B.; reported 0′ 10″)	1	300	40′
Concealed	53½	353½	
Coal, Upper Mercer (2260′ B.; reported 1′ 6″)	1½	355	55′
Concealed	15	370	
Slate, dark	2	372	
Coal, bony 0′ 9″; **Coal,** soft 1 10; **Coal,** hard 0 8 — (3′ 3″) **Stockton** (2240′ B.) M. P. Brooks Mine (No. 190 on Map II)	3	375	20′
Concealed	29	404	
Coal, hard, Coalburg (2210′ B.; reported 1′ 0″)	1	405	30′
Concealed	49	454	
Coal, Winifrede (2160′ B.; reported 1′ 2″)	1	455	50′
Concealed	79	534	
Coal, Cedar Grove (2080′ B.; reported 0′ 8″)	1	535	80′
Concealed	39	574	
Coal, Alma (2040′ B.; reported 1′ 2″)	1	575	40′
Concealed	24½	599½	
Coal, reported 2′ 0″; Slate, reported 2 0; **Coal,** reported 1 5 — (5′ 5″) **Campbell Creek, Peerless Bench** (2010′ B.) M. P. Brooks Mine, (No. 301 on Map II)	5½	605	30′
Concealed	139	744	
Coal, Eagle, (1870′ B.; reported 1′ 0″)	1	745	140′
Sandstone, massive, **Decota,** to Holly River	35	780	

The following section, measured with hand-level and arranged in descending order, starts at the top of a high point, 0.9 mile northeast of the mouth of Sugar Run of Sugar Creek, and descends southwestward to the mouth of the former stream where Skelt Post-Office is now located. At 705 feet the section connects with the top of the Holly Lumber Company No. 2 (5) Core Test, the record of which was not obtained:

Skelt Section, Holly District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (648′)			
Concealed and massive sandstone, Homewood	45	45	
Concealed, mostly shale	77	122	
Sandstone, massive, Upper Coalburg (Upper Connoquenessing?)	23	145	
Concealed in bench, Coalburg (Quakertown?) Coal horizon	15	160	160′
Sandstone, massive, Upper Winifrede	52	212	
Shale, dark and sandy, partly concealed	60	272	
Sandstone, massive, Peerless	50	322	
Concealed in bench	18	340	
Sandstone, Monitor	10	350	
Concealed, with sandy shale	35	385	
Slate, black, thickness concealed, Campbell Creek (No. 2 Gas) Coal horizon		385	225′
Concealed	32	417	
Sandstone, Brownstown	16	433	
Concealed, with dark shale	72	505	
Spring, with coal blossom, Little Eagle (?) (2330′ B.)		505	120′
Concealed	143	648	
Pottsville Series—New River Group (217′)			
Sandstone, massive, Upper Nuttall	40	688	
Dark slate and concealed to level of Holly Lumber Co. No. 2 Core Test (No. 5 on Map II) (2130′ B.)	17	705	
Sandstone, massive, Lower Nuttall	35	740	
Slate, dark	1	741	
Coal, (3′ 8″) Hughes Ferry (2090′ B.) medium-soft, columnar at base, (W. R. Cogar Mine, No. 554 on Map II)	4	745	240′
Concealed	25	770	
Sandstone, shaly, Middle Ieager	15	785	
Black slate and coal blossom, at old prospect, Lower Ieager (2050′ B.)		785	40′
Concealed and dark sandy shale	52	837	
Coal, Sewell "B" (Exposure No. 580 on Map II) (1997′ B.)	1	838	
Shale, gray	2	840	55′
Sandstone, massive, Lower Guyandot, makes falls in Sugar Creek, near mill	25	865	

The following section, arranged in descending order, was measured with aneroid, starting at the end of a mountain spur, one-fourth mile north of Summit Station, on the West Virginia Midland Railroad, and descending in a southerly direction to the railroad at the summit between Grassy Creek and Elk, and thence continuing westward to a sharp bend in the latter stream, one-half mile west of Summit Station. The Gilbert Coal was supplied from an opening west of Elk and nearly opposite the base of the section:

Summit Section, Holly District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (765′)			
Sandstone, massive, coarse, cliff rock, **Homewood**	90	90	
Concealed	30	120	
Sandstone, massive	30	150	
Concealed and shale	10½	160½	
Coal 1′ 1″ Slate, gray 0 3 **Coal** 0 6 **Coal**, bony 0 6 **Coal**, splinty 1 8 Slate, dark 0 4 **Coal** 0 2 — (4′ 6″) **Stockton** (2105′ B.) (Prospect No. 186 on Map II)	4½	165	165′
Concealed	20	185	
Coal blossom, Coalburg (2085′ B.)	.....	185	20′
Concealed	25	210	
Steep bluff, mostly sandstone	50	260	
Concealed in slope	30	290	
Slate, dark, sandy	12	302	
Coal 2′ 0″ Shale, sandy 5 6 **Coal** 1 6 — (9′ 0″) **Winifrede** (1959′ B.) W. Va. Midland R. R. Exposure (No. 226 on Map II)	9	311	126′
Fire clay shale	4	315	
Sandstone, massive, **Upper Chilton**, and concealed	25	340	
Coal, Chilton, (1927′ B.) reported	3	343	32′
Concealed and slate	12	355	
Slate, black, concealed 0′ 10″ **Coal**, medium-hard 3 8 Sulphur band 0 2 — (4′ 8″) **Cedar Grove** (1910′ B.) J. W. Brooks Mine (No. 255 on Map II)	5	360	17′
Shale	2	362	
Sandstone, massive, **Middle Cedar Grove**	4	366	
Slate, dark	7½	373½	

	Thickness Feet	Total Feet	
Coal, soft 0′ 7″ / Coal, bony 0 3 / Coal, soft 0 8 (1′ 6″) Lower Cedar Grove (1895′ B.) W. Va. Midland R. R. Exposure (No. 271 on Map II)	1½	375	15′
Fire clay shale	5	380	
Concealed and sandstone	2	382	
Coal (2′ 8″) Alma, (1885′ B.) Laura Brooks Mine (No. 275 on Map II)	3	385	10′
Sandstone, massive, Monitor	30	415	
Concealed	45	460	
Sandstone, massive	10	470	
Sandstone, shaly, and sandy shale	99½	569½	
Limestone, hard, gray, Stockton (?) (1700′ B.)	0½	570	
Shale, sandy	10	580	
Fire clay, Eagle Coal horizon (1688′ B.)	2	582	197′
Shale, dark	13	595	
Shale, sandy, dark, and concealed	167½	762½	
Coal, soft, Gilbert (supplied from west side) (Mine No. 535A on Map II)	2½	765	183′
Pottsville Series—New River Group (330′)			
Concealed	100	865	
Sandstone, massive, makes cliff south of Elk, Lower Nuttall (?)	45	910	
Concealed	95	1005	
Sandstone, shaly, Lower Guyandot	20	1025	
Shale, dark, sandy, with Naiadites fossils, Hartridge	8	1033	
Coal, medium-soft (1′ 8″), Sewell (1235′ B.) (Prospect No. 594 on Map II)	2	1035	270′
Fire clay shale and concealed	40	1075	
Sandstone, massive, Upper Raleigh (Sharon), to Elk River	20	1095	

The following section, measured with aneroid and arranged in descending order, starts at the line between Glade and Holly Districts, on the west side of Elk, one mile and a half west of Summit Station, and descends southeastward along a private road to the McCourt Ford:

McCourt Ford Section, Holly District.

	Thickness Feet	Total Feet	
Allegheny Series (230′)			
Concealed, sandstone, and concealed from top of ridge	75	75	
Coal, Upper Kittanning (2360′ B.) Andrew McCourt Heirs Mine (No. 26 on Map II) reported	5	80	80′
Concealed	30	110	

				Thickness Feet	Total Feet	
Sandstone, massive, **East Lynn**				45	155	
Concealed				75	230	
Pottsville Series—Kanawha Group (705′)						
Concealed				175	405	
Coal, soft	0′	6″	(9′ 7″) **Coalburg** (2045′ B.) Andrew McCourt Heirs Mine (No. 213 on Map II)	10	415	335′
Coal, hard	1	4				
Slate, black	0	6				
Coal, bony	1	4				
Coal, soft	1	7				
Slate, bony	0	4				
Coal, soft	1	9				
Coal, hard, splinty	2	3				
Slate and concealed				10	425	
Sandstone, massive, **Upper Winifrede**				40	465	
Concealed				70	535	
Sandstone				5	540	
Slate, black				15	555	
Coal blossom, Campbell Creek, (Peerless) (1883′ B.)				2	557	142′
Fire clay				6	563	
Coal blossom, Campbell Creek (No. 2 Gas) (1875′ B.)				2	565	8′
Shale and concealed				20	585	
Sandstone and concealed				30	615	
Sandstone, **Eagle**				30	645	
Shale, dark, **Eagle Coal horizon**				30	675	110′
Sandstone, massive, cliff rock, **Decota**				50	725	
Concealed				205	930	
Shale, dark				2	932	
Slate, black, cannel				0½	932½	
Coal, soft (2′ 6″) **Gilbert**, (1505′ B.) A. McCourt Heirs Mine (No. 535A on Map II)				2½	935	260′
Pottsville Series—New River Group (300′)						
Concealed				115	1050	
Sandstone, massive, **Lower Nuttall?**				30	1080	
Concealed				115	1195	
Sandstone, massive, concealed, and sandstone				35	1230	
Slate, black, to Elk River at McCourt Ford				5	1235	

The following section, measured with aneroid and arranged in descending order, starts at the top of a mountain, 0.7 mile eastward from Tracy Switch, on the West Virginia Midland Railroad, and extends westward, reaching Elk River 0.6 mile west of the switch. Owing to the westward dip of the strata the intervals are greater than true vertical measurement would show:

Tracy Section, Holly District.

	Thickness Feet	Total Feet	
Allegheny Series (190′)			
Sandstone, massive, coarse, **Lower Freeport**	50	50	
Concealed	45	95	
Sandstone, massive, coarse, partly concealed, **Upper East Lynn (?)**	50	145	
Concealed	45	190	
Fire clay and iron ore, **Lower Kittanning Coal horizon** (2480′ B.)	.....	190	190′
Pottsville Series—Kanawha Group (810′)			
Concealed, with sandstone debris	270	460	
Coal opening, abandoned, Winifrede (?) (2210′ B.) Jonathan Bennett mine (No. 230 on Map II)	.....	460	270′
Concealed	60	520	
Sandstone, massive, cliff, **Upper Chilton**	15	535	
Slate, black	4	539	
Coal, opening partly fallen shut, **Chilton**, (2130′ B.); Jonathan Bennett Mine (No. 245 on Map II) visible	1	540	80′
Concealed	68	608	
Sandstone, massive, makes cliff, **Upper Cedar Grove**	25	633	
Coal, soft (1′ 9″) **Cedar Grove** (2035′ B.); Jonathan Bennett prospect (No. 262 on Map II)	2	635	95′
Fire clay and concealed	90	725	
Sandstone, massive, **Brownstown**	35	760	
Shale, sandy, and concealed	65	825	
Slate, black	15	840	
Coal, streak, Eagle (1830′ B.)	.....	840	205′
Fire clay shale	1	841	
Shale, sandy, partly concealed to Tracy Switch (1720′ B.)	109	950	
Shale, dark, sandy	10	960	
Concealed	5	965	
Sandstone, massive, cliff, **Lower Gilbert** (1670′ B.)	35	1000	
Pottsville Series—New River Group (385′)			
Concealed	95	1095	
Sandstone, massive, coarse, great cliff, **Lower Nuttall** (1535′ B.)	40	1135	
Slate, dark	5	1140	
Concealed	20	1160	
Slate, dark	5	1165	
Sandstone, massive, great cliff, gray, medium-course, **Harvey** (1465′ B.)	35	1200	
Concealed	35	1235	
Slate, black, and concealed	47½	1282½	
Sandstone, massive, **Lower Guyandot**	30	1312½	
Slate, black, with iron ore streaks, **Hartridge**	15	1327½	
Coal, (0′ 8″) **visible, Sewell** (1345′ B.; Prospect No. 595 on Map II) reported	2½	1330	490′
Concealed to Elk River	55	1385	

The following section, measured partly with aneroid and partly with hand-level, and arranged in descending order, was measured by the writer in company with Capt. Baird Halberstadt, the well-known mining engineer, of Pottsville, Pa., who had previously made borings through the principal coals with the Halberstadt hand auger and had driven an open prospect into the Lower Kittanning. The section starts on the divide between Camp Creek and Houston Run, 2.6 miles southeast of Centralia, and descends eastward to the latter stream, where the Eagle Coal had been prospected and mined ten feet above the level of the run. Capt. Halberstadt is authority for the section of the Upper Freeport Coal, as measured on the shank of the auger. The westward dip of the strata makes the intervals between different formations slightly less than true vertical measurement would show:

Houston Run Section, Holly District.

	Thickness Feet	Total Feet	
Conemaugh Series (72')			
Coal blossom, Mahoning, and fire clay, flinty and plastic, **Thornton,** capping knob	5	5	
Concealed	5	10	
Sandstone, massive, **Lower Mahoning**	50	60	
Concealed, **Uffington Shale**	12	72	
Allegheny Series (248')			
Coal .... 1' 0" / Parting 0 6 / **Coal** .... 2 7 — (4' 1") **Upper Freeport (2060')** Dr. J. M. Brockerhoff Prospect (No. 2 on Map II)	4	76	76'
Concealed and shale	22	98	
Sandstone, massive, white, **Upper Freeport**	27	125	
Coal (0' 9"), Lower Freeport (2009' B.)	1	126	50'
Sandstone, massive, **Lower Freeport and Upper East Lynn**	120	246	
Concealed	29	275	
Shale, dark, sandy	3	278	
Coal .... 0' 9" / Shale, dark .... 0 8 / **Coal,** slightly slaty .... 1 0 / **Coal,** good .... 1 11 — (4' 4") **Middle Kittanning** Dr. J. M. Brockerhoff Prospect (No. 34A on Map II) (1853' B.)	4	282	156'
Fire clay	2	284	
Sandstone, soft, **East Lynn**	3	287	
Coal, (2' 6"), **Lower Kittanning,** Dr. J. M. Brockerhoff Prospect (No. 95 on Map II) (1845' B.)	3	290	8'
Concealed	20	310	
Coal blossom, (0' 8"), **Clarion** (Prospect No. 135 on Map II)	1	311	21'
Concealed	9	320	

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (460′)			
Sandstone, massive, Homewood	65	385	
Concealed	20	405	
Coal, blossom, Stockton (1730′ B.)	.....	405	94′
Concealed, with sandstone	65	470	
Coal blossom, Coalburg (1665′ B.)	.....	470	65′
Concealed	35	505	
Coal blossom, Winifrede (1630′ B.)	.....	505	35′
Concealed	20	525	
Bench	.....	525	
Concealed	55	580	
Bench, Cedar Grove Coal horizon	.....	580	75′
Concealed	75	655	
Slight bench, Campbell Creek Coal horizon	.....	655	75′
Concealed, with black shale	95	750	
Sandstone, massive, Eagle	12	762	
Shale, dark, Newlon	5	767	
Coal, Eagle, (3′ 3″) Dr. J. M. Brockerhoff Prospect, (No. 455 on Map II) (1365′ B.)	3	770	115′
Fire clay and sandy shale to Houston Run	10	780	

The following section, previously published by the Survey[11], was measured with aneroid by C. McC. Lemley, Assistant Engineer, Baltimore and Ohio Railroad, southwestward down the mountainside north of Elk River, 0.5 mile northwest of the mouth of Gulf Branch, having been furnished the Survey by W. T. Diggins, of Centralia. The various coals were correlated by Ray V. Hennen, who visited that region in the summer of 1915 and personally examined the lower 400 feet of the strata included in the section:

[11]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 103-104; 1917.

Gulf Run Section, Holly District.

	Thickness Ft.	In.	Total Ft.	In.	
Conemaugh and Allegheny Series (410′)					
Unrecorded	79	0	79	0	
Coal blossom, Mahoning	1	0	80	0	80′
Unrecorded	170	0	250	0	
Coal blossom, Lower Freeport	.....	..	250	0	170′
Unrecorded	155	4	405	4	
Coal, Lower Kittanning	4	8	410	0	160′
Pottsville Series (900′)					
Unrecorded	268	0	678	0	
Coal, Winifrede	2	0	680	0	270′
Unrecorded	229	2	909	2	
Coal blossom, No. 2 Gas	0	10	910	0	230′
Unrecorded	139	2	1049	2	

	Thickness Ft.	In.	Total Ft.	In.	
Coal, Little Eagle	0	10	1050	0	140′
Unrecorded	60	0	1110	0	
Coal, Gilbert?	..	..	1110	0	60′
Unrecorded	80	0	1190	0	
Coal 3′ 0″ } "Twin Seam,"					
Unrecorded 4 10 } Sewell "B"	10	0	1200	0	90′
Coal 2 2 }					
Unrecorded	34	10	1234	10	
Coal, soft, columnar, Sewell (1065′ B.)	5	2	1240	0	40′
Unrecorded to Elk River	70	0	1310	0	

MEASURED SECTIONS, FORK LICK DISTRICT.

Fork Lick District is situated in the eastern central portion of the county, comprising part of the Elk and Gauley River drainage basins. Its surface rocks range through the Kanawha and New River Groups of the Pottsville, the Mauch Chunk Series, and into the Greenbrier Limestone which crops in certain localities along Elk.

The following section starts at the top of a mountain on the south side of Little Grassy Creek, 1.2 miles southeast of the junction of that stream with Grassy Creek, and 2.2 miles northwest of Webster Springs, and extends northward to the foot of the mountain, where the Gilbert Coal has been mined on the land of Thomas Bender. The remainder of the section is the record of the **Neal Cool No. 2 (10) Coal Test Boring**, put down by Hon. John T. McGraw, and reveals the rapid northward thinning of the coals of the New River Group, which are present in good development on the south side of the same mountain ridge next to Elk River:

Little Grassy Creek Section, Fork Lick District.

Pottsville Series—Kanawha Group (553′)	Thickness Ft.	In.	Total Ft.	In	
Sandstone, massive, gray, from top of knob	15	0	15	0	
Concealed	43	0	58	0	
Slate, black, Cedar Grove Coal horizon (2395′ B.)	..	..	58	0	58′

	Thickness Ft.	In.	Total Ft.	In.	
Concealed in steep bank	100	0	158	0	
Coal, and slate mixed, reported 2′ 0″ / Coal, good, reported 2 0 — (4′ 0″) Campbell Creek Peerless (2291′ B.) Thomas Bender mine (No. 307A on Map II)	4	0	162	0	104′
Concealed	20	0	182	0	
Sulphur spring, with coal blossom, Campbell Creek (No. 2 Gas) (2271′ B.)	.....	..	182	0	20′
Concealed	18	0	200	0	
Sandstone, partly concealed, Eagle	25	0	225	0	
Concealed	18	6	243	6	
Coal, Eagle (2207′ B.) Thomas Bender Mine (No. 459 on Map II) reported	2	6	246	0	64′
Concealed	53	8	299	8	
Coal, Little Eagle, (2158′ B.) reported	0	4	300	0	54′
Concealed	155	0	455	0	
Sandstone, massive, Lower Gilbert	20	0	475	0	
Slate, bench	0	6	475	6	
Coal, Gilbert, (1975′ B.) Thomas Bender Mine (No. 536A on Map II) reported	2	6	478	0	178′
Stratigraphic interval to top of boring	75	0	553	0	
Continued by Neal Cool No. 2 (10) Coal Test Record (2035′ B.):					
Pottsville Series—New River Group (320′)					
Unrecorded	129	4	682	4	
Coal, Sewell "B"	0	8	683	0	
Unrecorded	23	0	706	0	
Coal, Sewell	2	0	708	0	230′
Unrecorded	15	9	723	9	
Coal, Welch	0	3	724	0	16′
Unrecorded	110	9	834	9	
Coal, Fire Creek	0	3	835	0	111′
Unrecorded to Mauch Chunk Reds	38	0	873	0	

The following section, measured with aneroid and arranged in descending order, starts at the top of the mountain, two miles north of Webster Springs, and extends southwestward to a road fork in the gap between Little Grassy Creek and Elk River and thence southward by the road to Webster Springs. In their proper places the Castle, Sewell, Welch, and Fire Creek Coals are inserted, having been observed in a locality where Mr. E. H. Gillespie has prospected

all four of them one-half mile east of the highway down which the section was measured. Inasmuch as the Sewell Coal has also been mined along the highway where the section was made there was no difficulty in connecting these coals with the remainder of the section. As shown by Map II this section was made in a region of steep northward dip, making the intervals very much shorter than true vertical measurement would show:

Webster Springs Section (North), Fork Lick District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (315′)			
Concealed from top of knob	80	80	
Sandstone, massive	20	100	
Concealed	60	160	
Coal blossom, Eagle?	.....	160	160′
Concealed	30	190	
Slate, black	5	195	
Shale, sandy	70	265	
Sandstone, massive, **Lower Gilbert**	50	315	
Pottsville Series—New River Group (345′)			
Concealed	25	340	
Sandstone	10	350	
Concealed	50	400	
Sandstone, massive, **Harvey**	30	430	
Concealed	42	472	
Shale, dark, **Sandy Huff**	10	482	
Coal, soft.. 0′ 11″ | (3′ 1″) **Castle**; E. H. Gillespie Prospect (No. 572 on Map II) (2345′)	3	485	325′
Shale and concealed	60	545	
Slate and **coal blossom, Sewell "B"**	.....	545	60′
Concealed and sandstone, massive, **Lower Guyandot**	23	568	
Coal, soft, columnar 1′ 4″ | (2′ 0″) **Sewell**; E. H. Gillespie Mine (No. 612 on Map II). (2260′ B.)	2	570	25′
Slate, black .. 0 0½			
Coal, hard..... 0 7½			
Fire clay, sandy shale, and concealed	5	575	
Sandstone, massive, **Welch**, and dark slate	33	608	
Coal, soft.. 1′ 3″ | (1′ 11″) **Welch**; E. H. Gillespie Prospect (No. 710 on Map II) (2220′ B.)	2	610	40′
Coal, bony 0 2			
Coal, soft. 0 6			
Shale, sandy, and concealed	32	642	
Slate, black, **Quinnimont**	15	657	
Coal, hard, Fire Creek (2′ 11″); E. H. Gillespie Prospect (No. 747 on Map II) (2170′ B.)	3	660	50′
Mauch Chunk Series (595′)			
Shale, red, mostly concealed	50	710	
Sandstone	2	712	
Concealed	18	730	

	Thickness Feet	Total Feet	
Sandstone, shaly	15	745	
Concealed	15	760	
Shale, red	25	785	
Sandstone, shaly, greenish-brown	10	795	
Shale, red	20	815	
Sandstone, massive, gray, hard, pebbly, Princeton	35	850	190′
Shale, red, and concealed	55	905	
Shale, red	20	925	
Sandstone, massive, greenish-red, with conglomeratic shale particles at base	20	945	
Shale, red, limy	7	952	
Limestone, shaly	3	955	
Shale, red	55	1010	
Sandstone, greenish-red	5	1015	
Shale, red	8	1023	
Sandstone, greenish-red	2	1025	
Concealed, with red shale	180	1205	
Sandstone, massive, gray	20	1225	
Shale, red, with limestone nodules	15	1240	
Sandstone, flaggy	5	1245	
Shale, dark and limy	5	1250	
Concealed	5	1255	405′
Greenbrier Limestone ( )			
Limestone, in Back Fork of Elk, **Greenbrier**		1255	

In the following section, arranged in descending order, the surface portion was measured with aneroid, starting at the top of Payne Knob, 1.3 miles south of Webster Springs, and extending northeastward to Cherry Falls where the old Summersville Pike crosses Elk, about one mile above the town. The lower portion is the record of the **C. P. Dorr No. 1 (17) Oil Test Well,** located on Elk one-half mile below the mouth of Back Fork, and drilled by the Webster Springs Heat and Light Company, resulting in only a slight show of gas. In the section below the measured section is recorded only down to the apparent stratigraphic level of the top of the well since there is a considerable rise in the rocks and an intervening syncline between the two points:

Webster Springs Section (South), Fork Lick District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (325′)			
Sandstone, massive, coarse, **Decota,** capping Payne Knob	25	25	25′
Concealed in slope	80	105	
Concealed in bench	25	130	

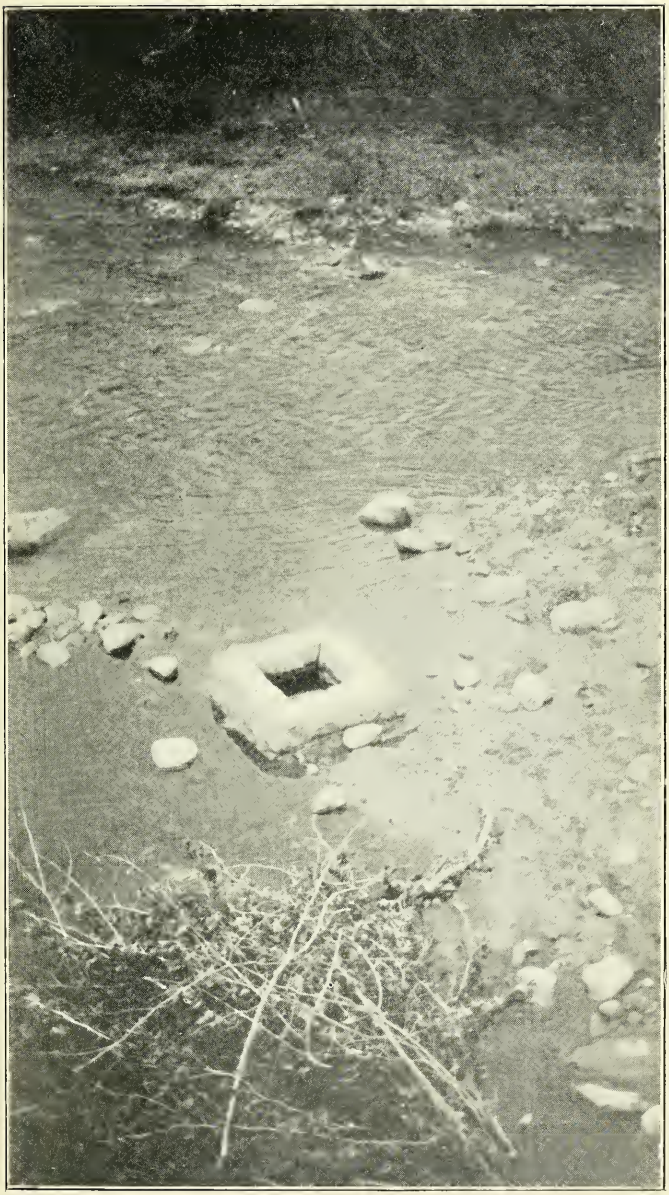

PLATE VII.—Old "Fork Lick" Salt Sulphur Spring at junction of Elk River and Back Fork, just below Webster Springs.

	Thickness Feet	Total Feet	
Sandstone, massive, coarse, cliff rock, Lower Gilbert	40	170	
Concealed	40	210	
Spring, Douglas Coal horizon	.....	210	185'
Concealed	58	268	
Sandstone, massive, Lower Dotson	20	288	
Coal, lenticular (1' 0" to 2' 0") Lower Douglas (2825' B.) W. G. Payne mine (No. 548 on Map II)	2	290	80'
Concealed	35	325	
Pottsville Series—New River Group (430')			
Sandstone, massive, Upper Nuttall	20	345	
Concealed	85	430	
Sandstone, in bluff, partly concealed, Lower Nuttall?	65	495	
Concealed	75	570	
Sandstone, shaly, Lower Guyandot	25	595	
Shale, dark, sandy, Hartridge	10	605	
Concealed	6	611	
Coal, Sewell, (2500' B.) E. H. Morton Mine (No. 632 on Map II), reported	4	615	325'
Concealed	2	617	
Sandstone, massive, Welch	10	627	
Coal, soft .. 2' 0" / Coal, bony splint.. 0 11 } (2' 11") Welch (2485' B.) E. H. Morton Mine (No. 719 on Map II)	3	630	15'
Concealed	60	690	
Sandstone, massive, Upper Raleigh (Sharon?)	55	745	
Concealed	10	755	
Mauch Chunk Series (899')			
Shale, red and variegated, and concealed	390	1145	
Sandstone, in bluff	60	1205	
Shale, red, partly concealed	250	1455	
Sandstone, flaggy	30	1485	
Shale, red, partly concealed	50	1535	
Sandstone, shaly, to stratigraphic level of well	10	1545	
Continued by C. P. Dorr No. 1 (17) Well Record (1430' B.):			
Shale, red	14	1559	
Lime	5	1564	
Shale, bluish-gray	41	1605	
Sand	10	1615	
Black, shale or coal?, Big Spruce Knob?	4	1619	
Shale, red	15	1634	
Shale, white	20	1654	1024'
Greenbrier Limestone (254')			
Lime	15	1669	
Lime, hard	21	1690	
Shale, dark	50	1740	
Lime	5	1745	
Shale, black	10	1755	
Lime	5	1760	
Sand	10	1770	
Shale, white	20	1790	

	Thickness Feet	Total Feet	
Lime, hard	5	1795	
Shale, light	15	1810	
Lime	6	1816	
Shale, soft, white	7	1823	
Lime	85	1908	
Pocono Sandstone Series (451′)			
Sand 60′ } Big Injun Sand 40 }	100	2008	
Coal, hard, good quality	3	2011	
Sand, Squaw	64	2075	
Red rock, shelly	70	2145	
Slate, dark and broken	25	2170	
Slate, white	30	2200	
Slate, white, shelly	95	2295	
Slate, white	30	2325	671′
Sand, Berea	34	2359	
Catskill Series (798′)			
Slate	10	2369	
Lime shells and slate	146	2515	
Slate, white, and streaks of hard lime	83	2598	273′
Sand, Gordon	15	2613	
Slate, white	93	2706	
Sand, Fourth	6	2712	
Slate, white	38	2750	152′
Sand, Fifth	15	2765	
Slate, white, soft	270	3035	
Lime	6	3041	
Slate, white	71	3112	
Lime	4	3116	
Slate, white	29	3145	395′
Lime, gritty, (gas pocket; strong smell of petroleum in sand), Elizabeth? Sand horizon	12	3157	
Chemung Series (473′)			
Slate, white	101	3258	
Red rock	4	3262	
Slate, white	178	3440	
Lime, gritty	12	3452	
Slate, white	178	3630	

The following section, measured with aneroid and arranged in descending order, starts at the top of the Potato Knob, on Point Mountain, and extends southwestward, mainly along the county road, to the ford of Elk River at Bernardstown, one-fourth mile below the mouth of Steps Run. Being measured practically on the strike of the rocks the intervals should represent true vertical measurement:

Bernardstown Section, Fork Lick District.

	Thickness Feet	Total Feet	
Allegheny Series (40′)			
Concealed with sandstone fragments	40	40	40′
Pottsville Series—Kanawha Group (645′)			
Sandstone, massive.... 5′ Concealed..... 25 Sandstone, massive.... 25 — **Homewood**	55	95	
Concealed	265	360	
Fire clay spring, **Cedar Grove Coal horizon**		360	320′
Concealed	85	445	
Fire clay spring, **Alma Coal horizon**		445	85′
Concealed and slate	32	477	
Shale, dark	4½	481½	
Coal, medium-soft..... 1′ 3″ Bone..... 0 1″ **Coal**, medium-hard..... 2 1 — (3′ 5″) **Campbell Creek (Peerless Bench)** (3015′ B.); **John Gregory Mine** (No. 311 on Map II)	3½	485	40′
Fire clay and concealed	15	500	
Sandstone, massive, **Brownstown**	45	545	
Concealed and black slate, **Eagle Coal horizon**	10	555	70′
Sandstone, massive, great cliff, **Lower Gilbert**	90	645	
Slate, dark, and concealed, **Gilbert Coal horizon**	40	685	130′
Pottsville Series—New River Group (440′)			
Sandstone, massive, **Upper Nuttall**	50	735	
Shale, sandy, partly concealed	80	815	
Slate, black	20	835	
Coal blossom, Hughes Ferry (2665′ B.)		835	150′
Fire clay shale	25	860	
Sandstone, shaiy, **Middle Iaeger**	35	895	
Concealed	15	910	
Slate, black, **Sandy Huff**	13	923	
Coal, (2′ 0″), **Castle** (Exposure No. 574 on Map II) (2575′ B.)	2	925	90′
Fire clay shale	5	930	
Sandstone, **Guyandot**	10	940	
Concealed and dark slate, **Hartridge**	47	987	
Coal, soft, (2′ 10″), **Sewell** (2510′ B.) Vincent Hamrick Mine (No. 649 on Map II)	3	990	65′
Fire clay, with plant roots	2	992	
Shale, sandy, with iron ore nodules	73	1065	
Sandstone, massive, **Upper Raleigh (Sharon)**	30	1095	
Shale, dark	3	1098	
Fire clay, flinty fracture, **Fire Creek Coal horizon** (2400′ B.)	2	1100	110′
Concealed	25	1125	
Mauch Chunk Series (675′)			
Shale, red	45	1170	
Sandstone, massive, **Princeton** (2275′ B.)	55	1225	
Shale, red	20	1245	
Sandstone, shaly	10	1255	
Shale, red	5	1260	
Sandstone, flaggy, green	15	1275	

	Thickness Feet	Total Feet
Shale, red, partly concealed	170	1445
Sandstone	15	1460
Shale, red	115	1575
Sandstone, massive (1875′ B.)	50	1625
Shale, red, and concealed	105	1730
Sandstone, massive, gray, great cliff, Webster Springs (?)	65	1795
Shale, red, to Elk River at Bernardstown	5	1800

The following section, previously published in the Barbour, Upshur and Western Randolph Report of the Survey, page 182, was made with aneroid starting at the top of a spur of Point Mountain, 1.2 miles southeast of Waneta and working northwestward toward Big Run of Elk, acknowledgment being due to Lee A. Hamrick who pointed out the various coal prospects which probably would not otherwise have been found as the ground was covered with snow a foot or more in depth. Certain revisions are made to conform to more recent information:

Waneta Section, Fork Lick District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (247′)			
Concealed from top of ridge	45	45	
Coal, soft, columnar, (1′ 8″), Eagle (3635′ B.), Lee A. Hamrick Prospect, (No. 464D on Map II)	2	47	47′
Concealed	200	247	
Pottsville Series—New River Group (478′)			
Concealed	28	275	
Sandstone, massive, with small pebbles, **Lower Nuttall**	65	340	
Coal, Hughes Ferry (3340′ B.), reported	.....	340	293′
Concealed	154.5	494.5	
Sandstone, massive, **Guyandot**	25	519.5	
Shale, dark	2	521.5	
Shale, gray	1	522.5	
Coal, soft.... 2′ 2″ / Bony splint 0 1 / **Coal**, hard.. 0 3 — **Sewell "B"** (3155′ B.) Jacob Fisher Prospect (No. 582A on Map II)	2.5	525	185′
Concealed	30	555	
Sandstone, massive, **Lower Guyandot**	15	570	
Shale	1	571	
Coal, hard, blocky, Sewell (3105′ B.), Jacob Fisher Prospect (No. 660 on Map II)	4	575	50′
Sandstone, massive, **Welch**	24	599	
Coal, Welch, (3080′ B.), Jacob Fisher Exposure, (No. 731A on Map II), reported	1	600	25′
Sandstone, massive, **Upper Raleigh (Sharon)**	75	675	
Shale, greenish-gray	30	705	
Sandstone, massive, coarse (2995′ B.)	20	725	
Mauch Chunk Series			
Shale, red	.....	.....	

The following section, previously published in the Barbour, Upshur and Western Randolph Report of the Survey, page 181, was measured with aneroid, starting at the top of Point Mountain, 1.9 miles east of Waneta and descending the trail to the mouth of Mill Run of Elk River, 1 mile southwest of Samp, having been made when the ground was covered with snow, many details not having been noted on that account:

Samp Section, Fork Lick District.

	Thickness Feet	Total Feet
Pottsville Series (515')		
Concealed from top of Point Mountain	460	460
Sandstone, massive, cliff rock, partly concealed (3085' B.), **Upper Raleigh (Sharon)**	55	515
Mauch Chunk Series (975')		
Concealed (2800' B.)	285	800
Red shale, partly concealed	290	1090
Sandstone, flaggy, partly concealed	125	1215
Concealed, with reds	215	1430
Limestone, **Hinton**, to Elk River	60	1490

In the above section certain revisions are made over the one formerly published, the top of the Mauch Chunk being shifted to conform to the structure as detailed information not then available has required. Also, the limestone at the base of the section has proved to be in the Mauch Chunk instead of being the top portion of the Greenbrier as was previously supposed, and it has therefore been correlated with the Hinton which belongs in that position. The section probably stops near the top of the Webster Springs Sandstone which is the basal member of the Mauch Chunk in the Elk Valley.

The following section, measured with aneroid and arranged in descending order, starts at the top of Redoak Knob, 2.6 miles southeast of Bergoo village, and extends southwestward to the vicinity of Redoak School, embracing a vertical interval of 170 feet. The remainder of the section starts with the same stratigraphic level, on the point of the mountain, 1.3 miles southeast of Bergoo, and continues northwestward to that village, the sandstone cliffs of the Mauch Chunk Series below 1335 feet having been observed on the north side of Elk opposite the village. By measuring the upper portion of the section at two different points, as noted above, a large amount

of rise in the strata was eliminated so that the intervals as published are only slightly in excess of those which true vertical measurement would show:

Bergoo Section, Fork Lick District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (400′)			
Sandstone, massive, capping Redoak Knob, Monitor	40	40	
Spring, with black slate on bench, Campbell Creek (Peerless) Coal horizon	.....	.....	40′
Concealed in slope	110	150	
Spring, with coal blossom, Eagle	.....	150	110′
Concealed	20	170	
Sandstone and concealed	85	255	
Spring, Lower War Eagle Coal horizon (3220′ B.)	.....	255	105′
Sandstone, massive, with small pebbles, great cliff, Lower Gilbert	75	330	
Concealed	25	355	
Slate, black	45	400	
Pottsville Series—New River Group (420′)			
Sandstone, massive, coarse, Upper Nuttall	50	450	
Concealed	55	505	
Sandstone, flaggy, Lower Nuttall	25	530	
Concealed	50	580	
Sandstone, Harvey	30	610	
Concealed	23	633	
Coal, slaty, Castle (2840′ B.) visible	2	635	380′
Sandstone	10	645	
Concealed and slate	42	687	
Coal blossom (2′ 10″) Sewell "B" (2785′ B.)	3	690	55′
Sandstone	15	705	
Slate, dark	13	718	
Coal blossom, Sewell (Exposure No. 651 on Map II) (2755′ B.) about	2	720	30′
Sandstone, Welch	19	739	
Shale, dark, sandy	17	756	
Coal, soft 0′ 5″ / Coal, cannelly 0 5 / Coal, soft 3 7 — (4′ 5″) Welch (2715′ B.) A. L. Cummings Mine (No. 725 on Map II)	4	760	40′
Concealed	10	770	
Sandstone, massive, cliff rock, Upper Raleigh (Sharon?)	25	795	
Concealed	25	820	
Mauch Chunk Series (855′)			
Shale, red	80	900	
Concealed	40	940	
Shale, variegated	50	990	
Limestone, shaly, with profuse marine fauna, Producti, Derbya, etc., Terry Limestone	5	995	235′
Shale, red, partly concealed	70	1065	
Sandstone, flaggy, green	10	1075	

	Thickness Feet.	Total Feet
Shale, red, partly concealed	260	1335
Sandstone	30	1365
Shale, red	20	1385
Sandstone, cliff rock	60	1445
Concealed, with reds	40	1485
Sandstone, cliff	40	1525
Concealed, with reds	50	1575
Sandstone, massive, **Webster Springs**, to Elk River at mouth of Leatherwood Creek	100	1675

The following section, measured with aneroid in company with H. F. Cromer, and arranged in descending order, starts at the top of a spur of Gauley Mountain, 1.2 miles southeast of the Whitaker Falls, and extends northwestward to Elk River at the foot of the Falls. The southeastward rise of the rocks makes the published intervals slightly in excess of what true vertical measurement would show:

Whitaker Falls Section, Mingo District, Randolph County.

	Thickness Feet	Total Feet	
Pottsville Series—New River Group (675′)			
Sandstone, massive, with small pebbles, capping knob, **Upper Nuttall**	50	50	
Concealed in slope	100	150	
Sandstone, in steep bank, partly concealed, **Lower Nuttall**	100	250	250′
Concealed in bench	50	300	
Sandstone, **Harvey**	30	330	
Concealed, with sandy shale	87	417	
Sandstone, massive, with small pebbles, **Lower Guyandot**	65	482	
Shale, sandy, with iron ore, **Hartridge**	3	485	
Coal, Sewell (4′ 8″) (W. Va. Pulp & Paper Co. Prospect, No. 700 on Map II) (3485′ B.)	5	490	240′
Concealed	15	505	
Sandstone, massive, **Welch**	50	555	
Concealed in bench	20	575	
Sandstone, massive, coarse, great ledge, **Upper Raleigh** (3300′ B.)	100	675	185′
Mauch Chunk Series (1145′)			
Shale, red, partly concealed	435	1110	
Sandstone, flaggy, cliff rock	35	1145	
Shale, red, partly concealed	255	1400	
Sandstone	25	1425	
Shale, red, partly concealed	315	1740	
Sandstone, massive 50′ / Sandstone, in upper falls 15 / Sandstone, in lower falls 15 — **Webster Springs Sandstone**	80	1820	1145′
Greenbrier Limestone Series ( )			
Limestone, in bed of Elk River, **Greenbrier** (top, 2155′ B.)	.....	1820	

The following section, measured with aneroid and arranged in descending order, starts at the top of Rocky Knob on Elk Mountain, 2.3 miles southeast of the mouth of Valley Fork of Elk River and 1.7 miles southwest of Blue Spring, and extends northwestward to Elk River at Folks' store, 0.3 mile above Valley Fork. Since there is a total stratigraphic rise in the rocks between the two points of 500 feet, the intervals, particularly in the Mauch Chunk Series, are much greater than true vertical measurement would show, it being likely that this series is little more than 1200 feet thick. The section reveals a streak of coal in the Mauch Chunk, as well as the fossil zone of the Hinton Limestone, both of which are unusual:

Elk Mountain Section, Mingo District, Randolph County.

	Thickness Feet	Total Feet	
New River Group (460′)			
Sandstone, massive, with small pebbles, capping Rocky Knob, Lower Nuttall	35	35	
Concealed in slope	110	145	
Steep bank, with sandstone	55	200	
Spring, Castle Coal horizon	.....	200	200′
Concealed in slope	80	280	
Shale, sandy	28	308	
Coal, (2′ 0″) soft, Sewell (4050′ B.) (Mine No. 701 on Map II)	2	310	110′
Concealed in slope	50	360	
Sandstone, massive, cliff rock, Upper Raleigh (Sharon?)	100	460	
Mauch Chunk Series (1610′)			
Concealed	150	610	
Sandstone, greenish-gray, Princeton	25	635	325′
Concealed	65	700	
Coal, streak, Pluto, (Exposure No. 758 on Map II), thickness concealed (3660′ B.)	.....	700	65′
Concealed, with red shale	1200	1900	
Limestone, shaly, with profuse marine fossils, Hinton	30	1930	1230′
Concealed	60	1990	
Sandstone, shaly	20	2010	
Shale, red and limy	30	2040	
Sandstone, massive, cliff rock, Webster Springs	20	2060	
Concealed	10	2070	140′
Greenbrier Limestone ( )			
Limestone, Greenbrier, in dry bed of Elk River	.....	2070	

The following section, measured with aneroid and arranged in descending order, starts at the top of Bee Knob,

one mile southeast of Bolair, and extends northwestward to the Gauley River at that village. In the lower part the Beckley and Fire Creek Coals which have been opened on the north side of the river are incorporated at their proper horizons. The section extends practically to the base of the Pottsville Series, and the red shales of the Mauch Chunk may belong in the concealed interval below the Fire Creek Coal although they were not observed. Being measured on a rapid northwestward dip of the strata, the intervals are greater than true vertical measurement would show:

Bolair Section, Fork Lick District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (365′)			
Sandstone, massive, with small pebbles, cliff rock, Decota	40	40	
Concealed	85	125	
Sandstone, massive, Lower Gilbert	30	155	
Concealed	160	315	
Bench, Douglas Coal horizon	.....	315	315′
Sandstone, Lower Dotson, and concealed in steep bank	50	365	
Bench, Lower Douglas Coal horizon	.....	365	50′
Pottsville Series—New River Group (615′)			
Sandstone, massive, coarse, partly concealed, Upper Nuttall	30	395	
Concealed	130	525	
Bench, Hughes Ferry Coal horizon	.....	525	160′
Concealed	95	620	
Coal blossom, at spring (Sewell "B") (2605′ B.)	.....	620	95′
Concealed	64	684	
Coal stripping, abandoned, (2538′ B.) Sewell Coal (Prospect No. 663 on Map II) reported	3	687	67′
Concealed and shale	18	705	
Coal, (4′ 9″), Welch (2515′ B.); Zebulon Bee Heirs Mine (No. 735 on Map II)	5	710	23′
Concealed	60	770	
Spring, Little Raleigh Coal horizon ? (2455′ B.)	.....	770	60′
Concealed	10	780	
Shale, red, iron ore vein ?	5	785	
Shale, sandy, concealed and dark slate	112	897	
Coal, Beckley; (Sol. Starcher Prospect) (No. 740 on Map II) (2325′ B.); reported 2′ 8″	3	900	130′
Concealed	20	920	
Coal digging, mostly slate?	.....	920	
Concealed and slate	12	932	
Coal (8′ 2″) Fire Creek; J. J. Miller mine (No. 749 on Map II)	8	940	40′
Concealed to Gauley River	40	980	

The following section, measured with aneroid and arranged in descending order, starts at the top of Turkey Mountain, one mile southwest of the mouth of Straight Creek, and extends northeastward to Gauley River at the mouth of that creek. Few coals were observed as most of the benches were covered with debris:

Turkey Mountain Section, Fork Lick District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (430′)			
Sandstone, massive, capping mountain, Eagle	20	20	
Concealed	40	60	
Sandstone, massive, with small pebbles, Lower War Eagle (3575′ B.)	55	115	
Concealed in bench, Lower War Eagle Coal horizon	15	130	130′
Sandstone, massive, coarse, Lower Gilbert	70	200	
Concealed in bench	45	245	
Sandstone, Dotson	75	320	
Concealed	10	330	
Slate, black, Douglas Coal horizon (3360′ B.)		330	200′
Concealed	20	350	
Sandstone, massive, with small pebbles, Lower Dotson	80	430	
Pottsville Series—New River Group (510′)			
Concealed in slope	250	680	
Sandstone in steep bluff, Guyandot and Lower Guyandot	110	790	
Spring, with coal blossom, Sewell (2900′ B.)		790	460′
Concealed in bench	50	840	
Concealed in steep slope	100	940	
Mauch Chunk Series (235′)			
Concealed in steep slope	205	1145	
Sandstone, massive, pebbly, Princeton Conglomerate, to mouth of Straight Creek	30	1175	385′

The following section, measured with aneroid and arranged in descending order, starts on a high mountain point, one mile northeastward from the Three Forks of Gauley, and extends southwestward along the Randolph-Webster County Line to Gauley at the Three Forks. At the horizon of the Sewell Coal a prospect was made but only one foot of coal was uncovered. It is possible, however, that a deeper drift into the mountain might reveal a second bench showing the full thickness of the seam:

Three Forks of Gauley Section, Fork Lick District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (200′)			
Sandstone, massive, with small pebbles, **Lower Gilbert**, capping knob	50	50	
Concealed	50	100	
Spring, with coal blossom, **Gilbert** (3660′ B.)	.....	100	100′
Concealed	30	130	
Sandstone, **Dotson**, and concealed	55	185	
Spring, **Douglas Coal horizon** (3575′ B.)	.....	185	85′
Concealed	15	200	
Pottsville Series—New River Group (530′)			
Sandstone, massive, with small pebbles, cliff rock, **Upper Nuttall**	45	245	
Concealed	165	410	
Sandstone, massive, pebbly, cliff rock, **Harvey**	45	455	
Fire clay spring, **Castle Coal horizon** (3305′ B.)	.....	455	270′
Concealed	154	609	
Spring, with coal, **Sewell** (3150′ B.); (Prospect No. 685 on Map II); visible	1	610	155′
Concealed	15	625	
Steep bank, with sandstone, **Welch**	50	675	
Concealed in bench	10	685	
Concealed in steep bank, with sandstone, **Upper Raleigh** (3035′ B.)	45	730	
Mauch Chunk Series (180′)			
Shale, red	35	765	
Sandstone, massive, partly concealed, pebbly, **Princeton Conglomerate**, to Three Forks of Gauley	145	910	

MEASURED SECTIONS, GLADE DISTRICT.

Glade District occupies approximately the southwestern third of the county, embracing portions of the Elk, Birch, Gauley, Williams, and Cranberry River drainage basins. Its surface rocks range from the lower portion of the Conemaugh, through the Allegheny Series, Kanawha, and New River Groups of the Pottsville Series and into the upper portion of the Mauch Chunk Reds.

The following section, measured with hand-level and arranged in descending order, starts at the top of a knob, 0.5 mile southwest of Erbacon, and extends eastward down to Laurel Creek. Owing to the southeastward rise of the rocks, the intervals in the section are slightly less than true vertical measurement would show:

Erbacon Section, Glade District.

	Thickness Feet	Total Feet	
Allegheny Series (220′)			
Sandstone, massive, pebbly, makes haystack pillars on knob, **Upper Freeport**	60	60	
Concealed in bench	10	70	
Concealed and massive sandstone, **East Lynn**	94	164	
Coal, splinty 2′ 0″ / Slate, dark, bony 1 2 / **Coal**, soft 0 9 / **Coal**, hard, splinty 2 3 — (6′ 2″) **Lower Kittanning** (2055′ B.); Thomas Johns Mine (No. 113 on Map II)	6	170	170′
Concealed	47	217	
Coal 1′ 8″ / Shale, gray 0 8 / **Coal** 0 6 — (2′ 10″) **Clarion** (2005′ B.) (Prospect No. 137 on Map II)	3	220	50′
Pottsville Series—Kanawha Group (480′)			
Sandstone, massive, **Homewood**	25	245	
Concealed	60	305	
Coal blossom, Upper Mercer (1920′ B.)	.....	305	85′
Concealed, mostly sandstone	40	345	
Coal blossom, Stockton (1880′ B.)	.....	345	40′
Concealed, with sandstone	15	360	
Bench	.....	360	
Sandstone, partly concealed	65	425	
Shale, dark, with limestone boulders, **Winifrede Limestone** (1790′ B.)	10	435	90′
Concealed	28	463	
Slate, dark	17	480	
Coal streak, Chilton (1745′ B.)	.....	480	45′
Concealed	33	513	
Bench	.....	513	
Concealed, with sandstone and shale	65	578	
Coal, (2′ 0″), **Campbell Creek (Peerless Bench)** (1645′ B.)	2	580	100′
Concealed, with shale	44	624	
Shale, dark	16	640	
Concealed	35	675	
Coal blossom, Eagle (1550′ B.)	.....	675	95′
Concealed to Laurel Creek	25	700	

The following section, made with aneroid, starts at the top of a high knob near the head of Missouri Creek, and 2.6 miles southwest of Erbacon, and follows the county road northeastward to the foot of the mountain, 0.8 mile southwest of that village. Owing to the dip of the rocks in the direction in which the section runs, intervals are slightly in excess of what true vertical measurement would show:

Missouri Creek Section, Glade District.

	Thickness Feet	Total Feet	
Conemaugh Series (65′)			
Sandstone, massive, pebbly, capping knob, **Lower Mahoning**	60	60	
Concealed	5	65	
Allegheny Series (325′)			
Sandstone, massive, **Upper and Lower Freeport**	135	200	
Concealed and sandstone	26	226	
Coal, medium-hard 1′ 5″ / **Coal**, bony splint .. 0 4 / **Coal**, medium-hard 1 0 / **Coal**, bony splint .. 0 4 / **Coal**, soft .. 0 7 — (3′ 8″) Upper Kittanning (2265′ B.) S. L. Mason Mine (No. 28 on Map II)	4	230	230′
Fire clay shale	5	235	
Sandstone, massive, **Upper East Lynn**	90	325	
Concealed, **Middle Kittanning Coal horizon**	35	360	
Sandstone, **East Lynn**, and concealed	25	385	
Coal blossom, Lower Kittanning (2110′ B.)	.....	385	155′
Fire clay shale, **Lower Kittanning**	5	390	
Pottsville Series—Kanawha Group (335′)			
Sandstone, massive, **Homewood**	50	440	
Concealed	45	485	
Coal blossom, Upper Mercer (2010′ B.)	.....	485	100′
Concealed	40	525	
Sandstone, concealed, and sandstone	30	555	
Coal blossom, Stockton (1940′ B.)	.....	555	70′
Concealed	5	560	
Sandstone, **Upper Coalburg**	50	610	
Concealed, **Coalburg Coal horizon**	15	625	
Sandstone, **Upper Winifrede**	15	640	
Shale, dark and concealed	2	642	
Coal, Winifrede (1850′ B.); A. F. Scott Prospect (No. 234 on Map II), reported	3	645	90′
Concealed	15	660	
Sandstone, **Lower Winifrede**, and concealed	50	710	65′
Coal, prospect, **Chilton**?, not much found? (1785′ B.)	.....	710	
Concealed to foot of hill	15	725	

The following section, measured with hand-level and arranged in descending order, starts at the top of a high knob, 0.7 mile southwest of Wainville, and extends eastward to Laurel Creek, 0.4 mile below Wainville, where it connects with the Webster Lumber Company No. 1 (17) Coal Test Boring, the record of which is not available. Being made on the strike of the strata, the intervals represent true vertical measurement:

Wainville Section, Glade District.

	Thickness Feet	Total Feet	
Conemaugh Series (15′)			
Sandstone, Lower Mahoning, and concealed..	15	15	
Allegheny Series (245′)			
Bench, Upper Freeport Coal horizon (2336′ B.)	.....	15	15′
Sandstone, massive, with small pebbles, Upper Freeport	55	70	
Concealed and sandstone, Lower Freeport	50	120	
Bench, Upper Kittanning Coal horizon	5	125	110′
Sandstone, massive, East Lynn, and concealed	110	235	
Coal blossom, Lower Kittanning (2116′ B.)	.....	235	110′
Concealed	25	260	
Pottsville Series—Kanawha Group (526′)			
Concealed	135	395	
Coal blossom, Stockton (1956′ B.)	.....	395	160′
Concealed	5	400	
Sandstone, massive, Upper Coalburg	55	455	
Concealed and black slate, Coalburg Coal horizon	20	475	80′
Concealed in bluff	105	580	
Sandstone, shaly, Upper Cedar Grove	20	600	
Concealed	55	655	
Coal blossom, Campbell Creek (Peerless Bench) (1696′ B.)	.....	655	180′
Shale, sandy	14	669	
Sandstone, Brownstown	18	687	
Shale, dark, sandy	28	715	
Limestone, siliceous, Stockton (0′ 6″)	0½	715½	
Shale, dark, sandy	12½	728	
Sandstone, massive, Eagle	15	743	
Concealed and slate	9½	752½	
Coal, (1′ 6″), Eagle, (1597′ B.)	1½	754	99′
Fire clay	2	756	
Sandstone, shaly	5	761	
Coal (0′ 4″)	.....	761	
Fire clay shale	10	771	
Coal (0′ 2″) Little Eagle	.....	771	
Shale, dark, sandy, to bore hole (17)	15	786	

The following section, measured with aneroid and arranged in descending order, starts at the top of a high ridge, near Mount Thomas School, and extends southward along the county road to Birch River, 0.7 mile east of Boggs. Owing to the rise of the strata, intervals are shorter than true vertical measurement would show:

Boggs Section, Glade District.

	Thickness Feet	Total Feet	
Conemaugh Series (40′)			
Sandstone, massive, pebbly, capping ridge, Lower Mahoning	40	40	
Allegheny Series (270′)			
Concealed	20	60	
Sandstone, massive, Upper and Lower Freeport	90	150	
Slate, dark	1½	151½	
Coal, splinty 1′ 8″ / Coal, bony splint 1 0½ / Coal, soft 0 8½ (3′ 5″) Upper Kittanning (2340′ B.); Henry Good Mine (No. 31 on Map II)	3½	155	155′
Fire clay shale	5	160	
Sandstone, massive, Upper East Lynn	45	205	
Shale, dark	5	210	
Sandstone, East Lynn, and concealed	73	283	
Coal, slaty 2′ 6″ / Coal, soft 1 0 / Coal, splint 3 3 (6′ 9″) Lower Kittanning (2205′ B.) Black Betsey Coal Co. Mine (No. 121 on Map II)	7	290	135′
Shale, and concealed, with ferriferous limestone, Vanport?	20	310	
Pottsville Series—Kanawha Group (620′)			
Steep bluff, with sandstone, Homewood	65	375	
Coal blossom, Upper Mercer (2120′ B.)	.....	375	85′
Concealed	70	445	
Coal blossom, Stockton (2050′ B.)	.....	445	70′
Fire clay shale and concealed	5	450	
Sandstone, Upper Coalburg, shaly, and concealed	55	505	
Fire clay and coal blossom, Coalburg (1990′ B.)	.....	505	60′
Concealed	60	565	
Fire clay and coal blossom, Winifrede (1930′ B.)	.....	565	60′
Shale, dark, with ferruginous limestone, one Lingula? found, Winifrede Limestone	15	580	
Sandstone, massive, Lower Chilton?	65	645	
Concealed	25	670	
Shale, dark, sandy	10	680	
Concealed	60	740	
Sandstone, Monitor	13	753	
Coal, (2′ 0″), Campbell Creek (Peerless Bench) (1740′ B.) Felix Bragg Prospect (No. 363 on Map II)	2	755	190′
Fire clay and concealed	5	760	
Shale, sandy, dark	34	794	
Coal, Powellton (1700′ B.) Felix Bragg Prospect (No. 384 on Map II); about	1	795	40′
Concealed, with sandstone and sandy shale	89	884	
Coal, (0′ 8″), Little Eagle (1610′ B.)	1	885	90′
Fire clay and shale	7	892	
Coal, (0′ 4″), Lower War Eagle (1603′ B.)	.....	892	7′
Fire clay and shale	8	900	
Sandstone, massive, Lower Gilbert, to Birch River at mouth of Laurel Fork	30	930	

The following section, measured with hand-level and arranged in descending order, starts at the top of Crites Mountain, 0.8 mile north of Skyles and descends to Birch River at the mouth of Skyles Creek, where the town of Skyles is situated, the section being principally in Nicholas County:

Skyles Section, Hamilton District, Nicholas County.

	Thickness Feet	Total Feet	
Conemaugh Series (53′)			
Sandstone fragments, Lower Mahoning, capping Crites Mountain	15	15	
Concealed	33	48	
Shale, dark, Uffington	5	53	
Allegheny Series (262′)			
Coal opening, fallen shut, (James Rose), Upper Freeport, reported	2	55	55′
Sandstone, massive, coarse, Upper Freeport	18	73	
Concealed in bench	35	108	
Coal, reported in James Rose water well, Lower Freeport	2	110	55′
Sandstone, massive, coarse, great cliff (slight break at 145′) Lower Freeport and Upper East Lynn	115	225	
Concealed	83	308	
Coal blosson, Lower Kittanning (1841′ L.), visible	2	310	200′
Concealed and fire clay, Lower Kittanning	5	315	
Pottsville Series—Kanawha Group (575′)			
Sandstone, massive, cliff, Homewood	40	355	
Concealed	45	400	
Sandstone, massive, Upper Coalburg (Upper Connoquenessing)	80	480	
Concealed in slope, mostly shale	45	525	
Sandstone, massive, Upper Winifrede	75	600	
Concealed in bench, Winifrede Coal horizon	10	610	300′
Steep bluff, with sandstone, Upper Chilton	40	650	
Bench, Chilton Coal horizon		650	40′
Concealed in bluff	60	710	
Sandstone, shaly, Peerless	20	730	
Concealed in bench, Alma Coal horizon	5	735	85′
Sandstone, massive, Monitor	20	755	
Shale, sandy	7	762	
Coal, cannel 0′ 9″ (2′ 11″) Campbell Creek Slate, (Peerless Bench)	3	765	30′
black 0 2 (1386′ L.) Davis-Eakin Coal, soft 2 0 Lumber Co. Opening			
Concealed	10	775	
Sandstone, shaly, Brownstown	65	840	
Shale, sandy	10	850	
Slate, black, horizon of Powellton Coal (1301′ L.)		850	85′
Concealed and sandstone, Eagle	40	890	
Coal prospect, Eagle (1261′ L.); (No. 491 Map II); not much found		890	40′
Sandstone, massive, Decota, visible in Skyles Creek		890	

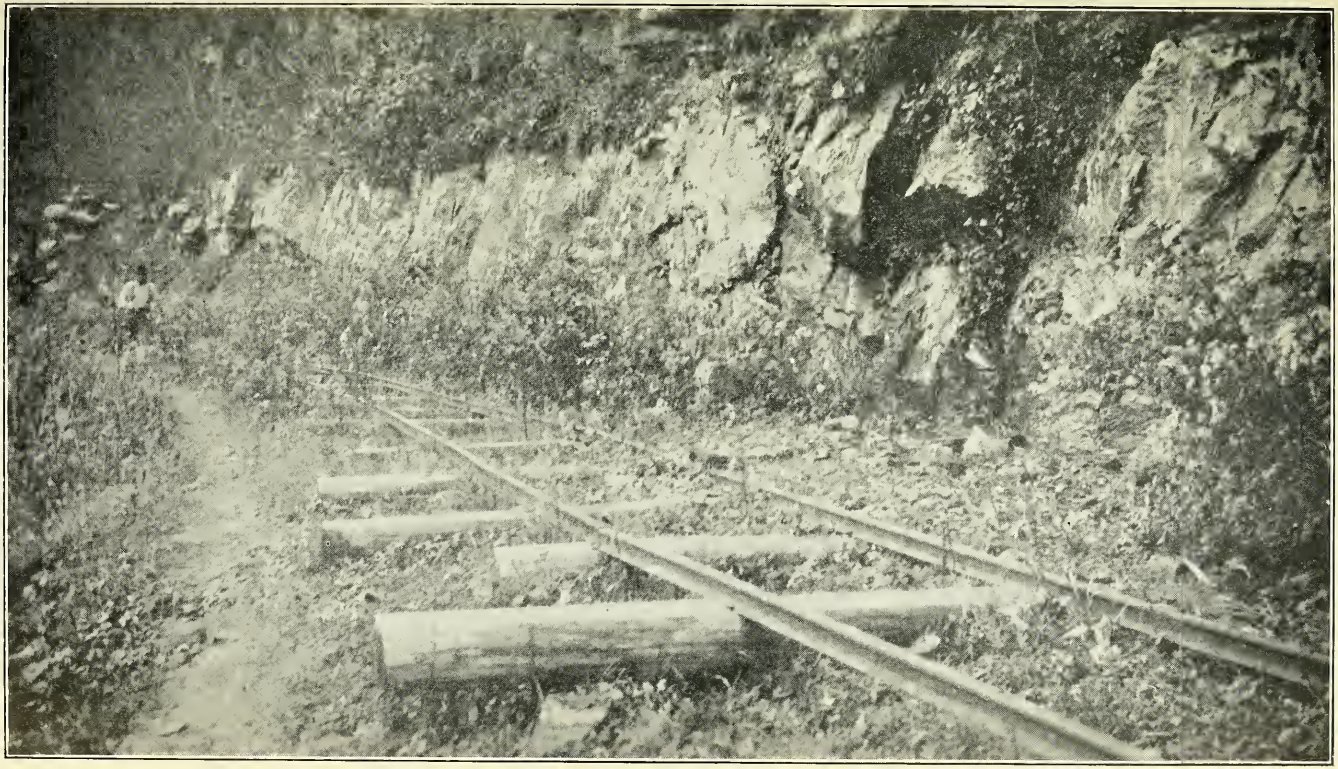

PLATE VIII.—Greenbrier Limestone outcrop, west side of Elk River at Webster Springs.

In the following section, which is the result of much painstaking labor, the surface portion was measured with hand-level and arranged in descending order, and the lower portion is the record of an oil test well. The section starts at the top of Cottle Knob, situated on a high ridge that reaches a height of 800 feet above the level of the Cottle Glades in the edge of Nicholas County, 2.8 miles west of Camden-on-Gauley, and descends eastward to the foot of the mountain at the head of Barn Run, a total vertical measurement of 815 feet. From this location the measures were carefully traced eastward to a point on the Cowen road, one mile northeast of Camden-on-Gauley, where the same strata outcrop, and the measurement is continued from that point southwestward, along the road to the mouth of Coon Creek, the same being recorded in the section between 815 and 1125 feet. The lower portion of the section is the record of the **J. N. Camden No. 1 (20) Oil Test Well,** drilled by Hon. J. N. Camden in 1898, the result being a dry hole. After the section was finished an additional trip was made over the entire surface portion in company with Ray V. Hennen, to whom credit is due for certain identifications in the Kanawha and New River Groups:

Camden-on-Gauley Section, Glade District.

	Thickness Feet	Total Feet	
Allegheny Series (225')			
Sandstone, massive, coarse, pebbly, capping Cottle Knob, **Upper Freeport**	50	50	
Concealed in bench	20	70	
Sandstone, massive, coarse, cliff rock, **Lower Freeport and East Lynn**	90	160	
Concealed and slate	24	184	
Coal, medium-hard 4' 0" | (5' 8") Lower Kittanning (2845')	6	190	190'
Coal, hard, splinty 1 8 | Williams Heirs Mine			
Shale, and concealed	35	225	
Pottsville Series—Kanawha Group (966')			
Sandstone, **Homewood,** and concealed in steep bluff	80	305	
Concealed in slope	40	345	
Bench, with **coal fragments, Stockton (2690')**		345	155'
Concealed in bluff	60	405	
Bench		405	
Sandstone in steep bluff, partly concealed, **Upper Winifrede**	67	472	

	Thickness Feet	Total Feet	
Shale, sandy	10	482	
Coal, soft..... 0′ 8″ Slate, bony.... 0 3 Coal, soft..... 0 7 Bone ..... 0 2 Coal, hard..... 0 11 Coal, soft..... 0 8 (3′ 3″) Winifrede (2550′ B.); John Woods Mine	3	485	140′
Concealed in steep bank, mostly sandstone	88	573	
Black slate and coal blossom, Chilton (reported 2′ 4″)	2	575	90′
Concealed	102	677	
Coal blossom at old prospect, Campbell Creek (Peerless Bench)	.....	677	102′
Concealed	13	690	
Coal, (0′ 9″ visible), Campbell Creek (No. 2 Gas)	1	691	14′
Concealed	82	773	
Sandstone, shaly, Eagle	2	775	
Slate, black	1	776	
Coal, soft.. 1′ 6″ Slate, bony 0 7 Coal, soft.. 1 8 (3′ 9″) Eagle (2255′) John Woods Mine	4	780	89′
Sandstone	25	805	
Concealed	10	815	
Coal, streak, (2220′)	.....	815	35′
(Continued by measurements northeast of Camden-on-Gauley):			
Shale, sandy	35	850	
Coal blossom, Little Eagle	.....	850	
Shale, dark, Eagle	20	870	
Slate, black, Little Cedar Coal horizon	.....	870	55′
Sandstone, shaly, Lower War Eagle	10	880	
Shale, sandy	13	893	
Coal ..... 0′ 10″ Shale, gray.. 0 4 Coal ..... 0 2½ Shale, gray.. 0 2½ Coal ..... 0 1 Shale, dark.. 0 1 Coal ..... 0 4 (2′ 1″) Lower War Eagle (Exposure No. 530 on Map II)	2	895	25′
Shale, sandy	45	940	
Concealed	10	950	
Sandstone, shaly at top, partly concealed, makes great cliff southwest of town, Lower Gilbert	35	985	
Coal, supplied from S. H. Fleming mine on Coon Run, (2′ 0″), Gilbert (Mine No. 538 on Map II)	2	987	92′
Concealed	7	994	
Sandstone, massive, coarse, gray, Dotson	60	1054	
Shale, sandy	16	1070	
Slate, dark	8	1078	
Fire clay streak, Douglas "A" Coal horizon	.....	1078	
Shale, sandy	14	1092	

	Thickness Feet	Total Feet	
Concealed	17	1109	
Sandstone, massive, and concealed to well	16	1125	
Continued by record of J. N. Camden No. 1 (20) Well (2020′ L.):			
Sand, brown, soft	23	1148	
Gravel, brown, soft	2	1150	
Slate, black, soft	6	1156	
Sand, gray, hard	4	1160	
Coal, soft, Douglas	3	1163	176′
Sand, white, hard, **Lower Dotson**	5	1168	
Slate, black, soft, **Douglas**	8	1176	
Sand, black, hard	9	1185	
Coal, soft, Lower Douglas	1	1186	23′
Slate, brown, soft	5	1191	
Pottsville Series—New River Group (634′)			
Sand, fine, gray, hard 16′ Slate, white, soft 6 Sand, black, hard 12 Shale, black, sandy, hard 10 Sand, black, hard 10 — **Upper Nuttall**	54	1245	
Slate, black, soft	40	1285	
Coal, soft	2	1287	101′
Sand, gray, pebbly, very hard, **Lower Nuttall**	92	1379	
Slate and shale, soft	13	1392	
Slate, black, soft, **Hughes Ferry Coal horizon**	11	1403	116′
Slate, black, sandy, hard	38	1441	
Slate, gray, soft	10	1451	
Sand, white, fine, hard, **Harvey**	39	1490	
Slate, black, soft, **Sandy Huff**	18	1508	
Sand, white, hard, **Guyandot**	17	1525	
Coal, soft, Sewell "B"	5	1530	127′
Sand, white, hard, **Lower Guyandot**	20	1550	
Slate, black, soft, **Hartridge**	33	1583	
Coal, soft, Sewell	1	1584	54′
Sand, gray, fine, hard, **Welch**	10	1594	
Slate, black, soft	51	1645	
Coal, soft, Welch	5	1650	66′
Slate, black, soft	5	1655	
Sand, black, hard 10′ Sand, white, hard 6 Sand, brown, soft 10 Sand, white, soft 5 Sand, brown, hard 35 — **Upper Raleigh (Sharon?) Rosedale Salt Sand**	66	1721	
Slate, white, soft	5	1726	
Shale, sandy, gray	20	1746	
Coal, soft, Fire Creek	3	1749	99′
Sand, white, hard, **Pineville**	47	1796	
Slate, gray, soft	13	1809	
Slate, white, soft	5	1814	
Sand, white, hard, base of Pottsville	11	1825	
Mauch Chunk Series (948′)			
Shale, red	2	1827	
Sand, gray, very hard 20′ Sand, white, very hard 10 Sand, black, very hard 43 Sand, gray, very hard 25 — **Princeton**	98	1925	176′

		Thickness Feet	Total Feet	
Shale, sandy, dark, soft		5	1930	
Sand, black, hard		10	1940	
Shale, red, soft		47	1987	
Shale, sandy, soft, greenish-gray		58	2045	
Slate, dark-gray, soft		7	2052	
Limestone, blue, hard		6	2058	
Shale, red, soft		37	2095	
Limestone, dark, slaty, soft		43	2138	
Slate, red, soft		75	2213	
Limestone, gray, siliceous, hard		47	2260	
Shale, red, soft		4	2264	
Sand, blue, hard		31	2295	
Shale, red, soft		10	2305	
Sand, blue, hard		25	2330	
Shale, red, soft		20	2350	
Sand, red, hard		5	2355	
Shale, red, soft		150	2505	
Sand, red, soft		5	2510	
Shale, red, soft		75	2585	
Limestone, gray, hard 5′ / Limestone, dark, slaty 52	Hinton	57	2642	
Limestone, black, hard		31	2673	
Slate, dark, limy, soft		12	2685	
Shale, gray, sandy, hard		10	2695	
Shale, dark, sandy, soft		60	2755	
Limestone, gray, siliceous, very hard, Little Lime		3	2758	
Slate, dark-gray, soft, Pencil Cave		15	2773	848′
Greenbrier Limestone (302′)				
Limestone, black, hard 82′ / Limestone, white, hard 23 / Sand, gray, very hard 2 / Limestone, gray, hard 4 / Sand, white, very hard 21 / Limestone, white, hard 170	Big Lime	302	3075	
Pocono Sandstones (551′)				
Sand, gray, very hard 8′ / Sand, brown, hard 10 / Sand, gray, hard 190	Big Injun	208	3283	
Slate, black, soft		230	3513	
Sand, gray, soft, Weir?		5	3518	
Shale, dark, soft		77	3595	822′
Sand, hard, gray, Berea?		10	3605	
Shale, dark-gray, soft		21	3626	

The following section, measured with aneroid and arranged in descending order, starts at the summit of a mountain road, 1.6 miles southwest of Dyer, and descends northward to Williams River, 0.8 mile west of the village. That portion of the section from 380 to 645 feet was secured on the north side of the valley as these measures were mostly concealed on the south side. Owing to the northwestward

dip of the strata the recorded intervals in the Kanawha Group are greater than true vertical measurement would show:

Dyer Section, Glade District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (280′)			
Concealed, with sandstone, **Lower Gilbert**	45	45	
Slate, dark	14	59	
Coal, (1′ 5″) Gilbert, (2780′ B.); Dean Mills Prospect (No. 544 on Map II)	1	60	60′
Fire clay and sandy shale	20	80	
Concealed	25	105	
Sandstone, massive, **Dotson**	35	140	
Concealed	25	165	
Coal blossom, Douglas (2675′ B.)	.....	165	105′
Concealed	40	205	
Sandstone, massive, **Lower Dotson**, and concealed	75	280	
Bench	.....	280	
Pottsville Series—New River Group (365′)			
Concealed	100	380	
Sandstone, massive, pebbly, **Lower Nuttall (2425′ B.)**	35	415	250′
Concealed in bench	15	430	
Shale, sandy, and concealed	64	494	
Sandstone, partly concealed	60	554	
Coal, (reported 1′ 3″) Castle (2285′ B.); John Chipps Prospect (No. 577 on Map II)	1	555	140′
Steep bluff, with dark shale and sandstone, **Guyandot**	80	635	
Concealed to Williams River	10	645	

The following section, measured with aneroid and arranged in descending order, starts at the top of Redoak Knob, 2.7 miles southeast of Dyer, and extends northeastward to the Williams River at the mouth of North Cove Run. Owing to the dip of the strata intervals are slightly greater than true vertical measurement would show, and the great amount of rocks and debris made the identification of the measures somewhat uncertain:

Redoak Knob Section, Glade District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (560′)			
Sandstone, partly concealed, capping knob, **Monitor (3580′ B.)**	85	85	
Bench, **Little Alma Coal horizon**	.....	85	85′
Concealed in slope	50	135	
Coal blossom, Campbell Creek (Peerless Bench) (3530′ B.)	.....	135	50′

	Thickness Feet	Total Feet	
Concealed, with sandstone debris	225	360	
Spring, Lower War Eagle Coal horizon	.....	360	225′
Concealed, with sandstone debris	200	560	
Pottsville Series—New River Group (550′)			
Concealed, with sandstone debris	215	775	
Bench, Hughes Ferry Coal horizon	.....	775	415′
Concealed	105	880	
Coal, Castle, (2785′ B.) not much found?	.....	880	105′
Concealed	125	1005	
Coal fragments, at sulphur spring, Sewell? (2660′ B.)	.....	1005	125′
Concealed	90	1095	
Coal blossom? at spring, Little Raleigh (2570′ B.)	.....	1095	90′
Concealed	15	1110	
Mauch Chunk Series (300′)			
Shale, red, and concealed	215	1325	
Sandstone, massive, pebbly, Princeton, and concealed to Williams River at mouth of North Cove Run	85	1410	

The following section, measured with aneroid and arranged in descending order, starts at the top of a high mountain spur, 0.7 mile east of the Three Forks of Williams River and extends northwestward to the forks of the river. Intervals are slightly greater than true vertical measurement would show:

Three Forks of Williams River Section, Glade District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (115′)			
Sandstone, massive, with small pebbles, Lower Dotson (3160′ B.)	90	90	
Concealed in bench	25	115	
Pottsville Series—New River Group (595′)			
Sandstone in steep bank, Upper Nuttall	105	220	
Concealed in slope	50	270	
Slate and coal blossom, (2980′ B.)	.....	270	
Concealed	20	290	
Slate, black	9	299	
Coal (1′ 0″) Hughes Ferry? (2950′ B.)	1	300	300′
Fire clay and concealed	5	305	
Sandstone, massive, cliff, Harvey	15	320	
Concealed	110	430	
Slate, black	.....	430	
Sandstone, massive, partly concealed, Lower Guyandot	70	500	
Concealed and black slate, with Lingulae, Hartridge	7	507	
Coal 0′ 8″ / Slate, gray 0 6 / Coal, soft 1 7 (2′ 9″) Sewell (2740′ B.) Prospect No. 696 on Map II)	3	510	210′

	Thickness Feet	Total Feet	
Slate and concealed in steep bank	90	600	
Bench	.....	600	
Concealed	110	710	
Mauch Chunk Series (175′)			
Shale, red, and concealed	65	775	
Sandstone, massive, **Princeton**	35	810	300′
Shale, red, to Three Forks of Williams River	75	885	

The following section, measured with aneroid and arranged in descending order, starts at a road fork just west of Anderson School, Beaver District, Nicholas County, and extends southeastward along the highway to the Gauley River at Cranberry Station. Owing to the rapid southeastward rise of the strata, intervals are considerably less than true vertical measurement would show:

Cranberry Section, Beaver District, Nicholas County.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (330′)			
Sandstone, massive, **Lower Gilbert**	40	40	
Concealed, and sandy shale	32	72	
Shale, gray	1½	73½	
Coal, slaty 0′ 4″ / **Coal**, medium-hard, columnar 1 2 — (1′ 6″) **Gilbert** (2400′ B.); James Ward Mine	1½	75	75′
Shale, concealed, and sandstone, **Dotson**, in bluff	60	135	
Bench	5	140	
Concealed	60	200	
Sandstone, massive, **Lower Dotson**	25	225	
Concealed	15	240	
Coal blossom, Lower Douglas (2235′ B.)	.....	240	165′
Concealed, with sandstone and shale	90	330	
Pottsville Series—New River Group (245′)			
Sandstone, massive, pebbly, **Upper Nuttall**	30	360	
Concealed	5	365	
Coal blossom (2110′ B.)	.....	365	125′
Sandstone, massive, partly concealed, **Lower Nuttall**	70	435	
Slate, black	.....	435	
Sandstone, shaly, **Harvey**	35	470	
Slate, dark, sandy, **Sandy Huff**	4	474	
Coal, (visible 1′ 3″), Castle (2000′ B.)	1	475	110′
Sandstone, massive, **Guyandot**	55	530	
Concealed	22	552	
Coal 0′ 1″ / Slate, black 1 4 / **Coal**, soft, columnar 1 10 — (3′ 3″) **Sewell** (1920′ B.)	3	555	80′
Concealed	20	575	
Coal, reported in river at bridge abutments, **Welch** (1900′ B.)	.....	575	20′

The following section, measured with aneroid and arranged in descending order, starts at the top of a mountain bluff, 1.1 miles northeast of Camp 4, which is at the mouth of Barrenshe Run of Cranberry River, and extends southwestward to the river at the mouth of two short branches that flow into the river from the north. Being made along the strike of the rocks intervals represent true vertical measurement:

Camp 4 on Cranberry Section, Beaver District, Nicholas County.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (75′)			
Sandstone, massive, coarse, great cliff, **Lower Dotson**	55	55	55′
Concealed in bench	20	75	
Pottsville Series—New River Group (535′)			
Concealed in slope	65	140	
Concealed in wide bench	35	175	
Sandstone, massive, coarse, small pebbles, cliff rock, **Lower Nuttall**, (2525′ B.)	35	210	155′
Concealed	125	335	
Sandstone, massive, coarse, **Guyandot**	30	365	
Concealed	75	440	
Slate, dark, **Sewell Coal horizon** (2295′ B.)		440	230′
Concealed	50	490	
Sandstone, massive, hard, gray, **Upper Raleigh (Sharon?)**	35	525	
Concealed	7	532	
Slate, black, **Little Raleigh Coal horizon**	3	535	95′
Concealed to Cranberry River	75	610	

The following section, measured with aneroid and arranged in descending order, starts at the top of Snakeden Mountain, 3.2 miles northwest of the common corner of Webster, Nicholas, and Greenbrier, and extends northward to the Cranberry River at the mouth of Mill Branch. Identifications in the section are somewhat uncertain because of the great amount of debris and lack of exposed strata:

Snakeden Mountain Section, Glade District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (255′)			
Sandstone, massive, pebbly, cliff rock, capping knob, **Dotson**	70	70	
Concealed	60	130	
Spring, **Douglas Coal horizon** (3700′ B.)		130	130′

	Thickness Feet	Total Feet	
Concealed	40	170	
Spring, Lower Douglas Coal horizon (3660′ B.)	.....	170	40′
Concealed	10	180	
Sandstone fragments, pebbly, in slope, Lower Dotson	75	255	
Pottsville Series—New River Group (675′)			
Sandstone fragments in slope, Upper Nuttall	50	305	
Concealed in bench	50	355	
Sandstone, massive, pebbly, partly concealed, Lower Nuttall (3400′ B.)	75	430	260′
Concealed	135	565	
Bench, Castle Coal horizon (3265′ B.)	.....	565	135′
Concealed, with black slate	95	660	
Sandstone, massive, Lower Guyandot	20	680	115′
Concealed, should have Sewell Coal near top	130	810	
Sandstone, massive, Upper Raleigh (Sharon?)	55	865	
Concealed	5	870	
Fire clay shale, with coal fragments, Fire Creek (2960′ B.)	.....	870	190′
Concealed in bluff	60	930	
Mauch Chunk Series (400′)			
Concealed in slope	100	1030	
Sandstone, flaggy, green, partly concealed, Princeton	90	1120	250′
Concealed	35	1155	
Sandstone, flaggy	35	1190	
Concealed, with reds, to Cranberry River	140	1330	

The following section, measured with aneroid and arranged in descending order, starts at the top of a high mountain spur, 0.8 mile northwest of Dogway, and extends eastward to Dogway Fork of Cranberry about one-half mile north of the village. Owing to the rise of the rocks intervals are slightly less than true vertical measurement would show. At the time the section was made the mountain was covered with snow and numerous details may have escaped notice:

Dogway Section, Glade District.

	Thickness Feet	Total Feet	
Pottsville Series—Kanawha Group (300′)			
Sandstone, massive, Grapevine? (3875′ B.)	35	35	
Concealed in slope	250	285	
Bench, Lower Douglas Coal horizon (3610′ B.)	15	300	300′
Pottsville Series—New River Group (580′)			
Sandstone, massive, cliff rock, coarse, Upper Nuttall	35	335	

	Thickness Feet	Total Feet	
Bench	25	360	
Sandstone, massive, pebbly, cliff rock, Lower Nuttall (3510′ B.)	40	400	100′
Concealed	160	560	
Bench, Castle Coal horizon (3350′ B.)	.....	560	160′
Sandstone, massive, Guyandot	25	585	
Concealed	60	645	
Sandstone, massive, Lower Guyandot	25	670	
Bench, with black slate, Sewell Coal horizon (3190′ B.)	.....	670	110′
Concealed, with black slate	80	750	
Shale, sandy, and concealed	45	795	
Sandstone, shaly, Quinnimont	30	825	
Shale, sandy, Quinnimont	20½	845½	
Coal, Fire Creek; Cherry R. B. & L. Co. mine (No. 754 on Map II) (3060′ B.)	4½	850	180′
Concealed and sandy shale to Dogway Fork	30	880	

In the following section arranged in descending order, the surface portion was measured with aneroid, starting at the top of Big Spruce Knob, Edray District, Pocahontas County, 6.5 miles northwest of Marlinton, and descending southwestward, along the strike of the rocks, to Williams River, where it connects with the record of the **Pocahontas County Coal and Land Company No. 1 (24) Oil Test Well,** drilled by that company on its own land, the record being furnished by Mr. Hubert Echols, of Marlinton, an official of the company, who kindly acted as guide when the section was measured. The section not only gives valuable and accurate information regarding the oil sands in this locality but also furnishes a complete vertical measurement of the Mauch Chunk Series with a total thickness of 1877 feet, at a point five miles east of the Webster line, and records a most remarkable showing of coal in that series, the same being much greater than anything hitherto reported in the same group elsewhere in the State, as it usually contains no coal at all. This coal outcrop will be discussed more fully in Chapter VIII under the description of the Mauch Chunk Series. The section is as follows:

Big Spruce Knob Section, Edray District, Pocahontas County.

	Thickness Feet	Total Feet	
Pottsville Series—New River Group (40′)			
Sandstone, massive, pebbly, Raleigh (Sharon), capping Big Spruce Knob	40	40	40′
Mauch Chunk Series, (1877′)			
Concealed and sandstone	150	190	
Concealed, with reds	90	280	
Sandstone, massive, cliff rock, Princeton	40	320	280′
Concealed, with reds, in steep slope	110	430	
Bench	.....	430	
Concealed, with reds, in steep slope	120	550	
Bench	.....	550	
Shale, red, partly concealed	500	1050	
Sandstone, flaggy, green, Big Spruce Knob	30	1080	
Shale, gray, Big Spruce Knob	2 to 0	1080	
Coal, Big Spruce Knob, (3615′ B.; fallen shut, reported 4′ 10″)	5	1085	765′
Concealed and sandstone to level of well	225	1310	
Continued by Pocahontas County Coal & Land Co. No. 1 (24) Well (3390′ B.):			
Unrecorded	180	1490	
Lime formation, Hinton	50	1540	455′
Unrecorded	377	1917	377′
Greenbrier Limestone (546′)			
Big Lime	546	2463	
Pocono Series (659′)			
Unrecorded	164	2627	
Sand, Big Injun, (oil show?)	145	2772	
Red rock	101	2873	
Unrecorded	5	2878	
Sand, Squaw?	104	2982	
Red rock	109	3091	1174′
Sand, white, Berea?	31	3122	
Catskill Series (730′)			
Sand, broken	146	3268	
Shale	50	3318	
Sand, good, Fifty-foot and Thirty-foot?	245	3563	
Slate	19	3582	
Red rock	64	3646	555′
Sand, Gordon?	36	3682	
Slate	12	3694	
Sand, Fourth?	60	3754	
Slate	13	3767	121′
Sand, Fifth?	85	3852	
Chemung Series (490′)			
Slate and shell to bottom	490	4342	

"Hole was drilled 10″ diameter for 120′; 8″ for 1520′; 6¼″ for balance; 660′ of 8″ casing being used. Hole was entirely free from water below the casing. No salt water in well at all. A slight showing of oil was found in the upper sand, sufficient to grease the tools and bailer. All sand struck was very, very hard."

Mr. Echols is of the opinion that some oil was found above the Big Lime and this may have been the case, but from the driller's record it would appear that the "Upper Sand" mentioned in his notes is the Big Injun, and the oil show has been so inserted by the writer, as no other sand is recorded above that horizon.

SUMMARY OF MEASURED SECTIONS.

For convenient reference the thickness of the stratified rocks of Webster, as determined by the measured sections in this Chapter, is compiled in the following table, showing not only the thickness of the various series but also the totals for the Pennsylvanian, Mississippian, and Devonian Rocks down to the lowest depth to which the drillings have penetrated them. A line of dots under a series indicates that it was not exposed where the section was made. A question mark indicates that the series was present but could not be differentiated from the one overlying or below it. In some cases a section shows a thickness of a series either too great or too small, owing to the dip of the measures where it was made, but as far as possible such places were avoided, care being taken to make the sections on the strike. In many cases the sections show only part of a series, the remainder not being exposed. An explanation accompanies each section, where published in full in the preceding text, detailing the conditions under which it was made:

Table Showing Thickness of Stratified Rocks in Webster County.

Place Measured	Pennsylvanian						Mississippian				Devonian			
			Pottsville											
	Conemaugh	Allegheny	Kanawha	New River	Total	Total	Mauch Chunk	Greenbrier Limestone	Pocono Sandstones	Total	Catskill	Chemung	Total	Total Section
Arvondale Junction	.....	70	612	453	1065	1135	671	60	(?)	(?)	(?)	(?)	(?)	5474
Bergoo	.....	.....	400	420	820	820	855	.....	.....	855	.....	.....	.....	1675
Bernardstown	.....	40	645	440	1085	1125	675	.....	.....	675	.....	.....	.....	1800
Big Run	.....	105	760	105	865	970	.....	.....	.....	.....	.....	.....	.....	970
Big Spruce Knob	.....	.....	.....	40	40	40	1877	546	659	3082	730	490	1220	4342
Boggs	40	270	620	.....	620	930	.....	.....	.....	.....	.....	.....	.....	930
Bolair	.....	.....	365	615	980	980	.....	.....	.....	.....	.....	.....	.....	980
Camden-on-Gauley	.....	225	966	634	1600	1825	948	302	551	1801	.....	.....	.....	3626
Camp 4 on Cranberry	.....	.....	75	535	610	610	.....	.....	.....	.....	.....	.....	.....	610
Cleveland	100	260	(?)	(?)	845	1205	575	165	425	1165	257	.....	257	2627
Cranberry	.....	.....	330	245	575	575	.....	.....	.....	.....	.....	.....	.....	575
Diana	.....	205	800	.....	800	1005	.....	.....	.....	.....	.....	.....	.....	1005
Dogway	.....	.....	300	580	880	880	.....	.....	.....	.....	.....	.....	.....	880
Dyer	.....	.....	280	365	645	645	.....	.....	.....	.....	.....	.....	.....	645
Elk Mountain	.....	.....	.....	460	460	460	1610	.....	.....	1610	.....	.....	.....	2070
Erbacon	.....	220	480	.....	480	700	.....	.....	.....	.....	.....	.....	.....	700
Gulf Ruu	(?)	(?)	(?)	(?)	900	1310	.....	.....	.....	.....	.....	.....	.....	1310
Holly	60	290	310	.....	310	660	.....	.....	.....	.....	.....	.....	.....	660
Houston Run	72	248	460	.....	460	780	.....	.....	.....	.....	.....	.....	.....	780
Jumbo	.....	197	833	399	1232	1429	367	.....	.....	367	.....	.....	.....	1796
Laurel Fork of Holly	.....	260	520	.....	520	780	.....	.....	.....	.....	.....	.....	.....	780
Little Grassy Creek	.....	.....	553	320	873	873	.....	.....	.....	.....	.....	.....	.....	873
Marpleton	.....	220	505	.....	505	725	.....	.....	.....	.....	.....	.....	.....	725
McCourt Ford	.....	230	705	300	1005	1235	.....	.....	.....	.....	.....	.....	.....	1235
Missouri Creek	65	325	335	.....	335	725	.....	.....	.....	.....	.....	.....	.....	725
Palmer	60	270	285	.....	285	615	.....	.....	.....	.....	.....	.....	.....	615
Pugh	.....	220	480	.....	480	700	.....	.....	.....	.....	.....	.....	.....	700
Redoak Knob	.....	.....	560	550	1110	1110	300	.....	.....	300	.....	.....	.....	1410
Samp	.....	.....	(?)	(?)	515	.....	975	.....	.....	975	.....	.....	.....	1490
Silica	.....	.....	580	.....	580	580	.....	.....	.....	.....	.....	.....	.....	580
Skelt	.....	.....	648	217	865	865	.....	.....	.....	.....	.....	.....	.....	865
Skyles	53	262	575	.....	575	890	.....	.....	.....	.....	.....	.....	.....	890
Snakeden Mountain	.....	.....	255	675	930	930	400	.....	.....	400	.....	.....	.....	1330
Summit	.....	.....	765	330	1095	1095	.....	.....	.....	.....	.....	.....	.....	1095
Three Forks of Gauley	.....	.....	200	530	730	730	180	.....	.....	180	.....	.....	.....	910
Three Forks of Williams	.....	.....	115	595	710	710	175	.....	.....	175	.....	.....	.....	885
Tracy	.....	190	810	385	1195	1385	.....	.....	.....	.....	.....	.....	.....	1385
Turkey Mountain	.....	.....	430	510	940	940	235	.....	.....	235	.....	.....	.....	1175
Wainville	15	245	526	.....	526	786	.....	.....	.....	.....	.....	.....	.....	786
Waneta	.....	.....	247	478	725	725	.....	.....	.....	.....	.....	.....	.....	725
Webster Springs (North)	.....	.....	315	345	660	660	595	.....	.....	595	.....	.....	.....	1255
Webster Springs (South)	.....	.....	325	430	755	755	899	254	451	1604	798	473	1271	3630
Wheeler	80	260	492	.....	492	832	.....	.....	.....	.....	.....	.....	.....	832
Whitaker Falls	.....	.....	.....	675	675	675	1145	.....	.....	1145	.....	.....	.....	1820
Wildcat	.....	195	320	.....	320	515	.....	.....	.....	.....	.....	.....	.....	515

CHAPTER V.

STRATIGRAPHY OF THE CONEMAUGH AND ALLEGHENY SERIES.

GENERAL ACCOUNT, CONEMAUGH SERIES.

The Conemaugh Series of the Pennsylvanian Rocks, first named by Franklin Platt, in 1878, from its outcrop along the Conemaugh River in Pennsylvania, comprises only an insignificant portion of the surface rocks of Webster. As shown on Map II its areal limit is confined to a strip along the northwestern border where the series caps some of the high ridges, a total thickness of about 100 feet being recorded in a few localities. Inasmuch as only a small portion of the series is present in Webster no general section of its entire thickness will be given but reference is made to previous County Reports of the Survey[1] on adjoining areas where these details are given in full.

That portion of the series found in Webster consists of heavy gray or brown sandstone beds, sometimes pebbly, with gray or brown shale deposits intervening, sometimes accompanied by a thin streak of coal or fire clay. The red beds which occur in the upper portion of the series have been almost entirely eroded and that portion remaining is therefore more typical of the Allegheny or Pottsville than of the true Conemaugh.

[1]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 182-183; 1917; D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, pp. 202-203; 1918.

DESCRIPTION OF MEMBERS, CONEMAUGH SERIES.

UPPER MAHONING SANDSTONE.

The Upper Mahoning Sandstone of H. D. Rogers and White[2], being the uppermost stratum of the Conemaugh noted in Webster, is usually a massive gray cliff, 25 to 50 feet in thickness, sometimes carrying quartz pebbles. In the section for Cleveland, page 69, it is noted as being gray, pebbly, and 60 feet thick, capping a high knob in the edge of Upshur County just north of the village. In the section for Wheeler, page 73, it is recorded as being 30 feet thick. At the head of Carpenter Fork of Laurel Creek, it is apparently this stratum that caps the summit of a high ridge 2 miles southeast of Erbacon, its thickness being 75 feet and its base being 60 feet above an old opening in the Upper Freeport Coal.

The Sutton Limestone of Hennen[3], described as a dark-gray, siliceous limestone, weathering yellow, and being 2 feet or less in thickness and coming just below the Upper Mahoning Sandstone, was not observed in Webster, its horizon being concealed at the few points noted above where it might occur.

The Middle Mahoning Sandstone of Hennen[4], described as sometimes occurring just below the Sutton Limestone, was not observed in Webster, being evidently a more western development of the series.

MAHONING COAL.

The Mahoning Coal of White[5], belonging in the interval between the Upper and Lower Mahoning Sandstones, and apparently a few feet below the Sutton Limestone later described by Hennen, as noted above, is of no importance as an economic horizon in Webster although it was noted at a few

[2]I. C. White, Vol. II, W. Va. Geol. Survey, p. 305; 1903.

[3]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, p. 218; 1917.

[4]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 221-222; 1917.

[5]I. C. White, Bull. 65, U. S. Geol. Survey, p. 94; 1891.

points. In Holly District, east of Centralia, it was noted by Lemley in the Gulf Run Section, page 92, where its blossom is reported as being 1 foot thick. On Houston Run, in the same region, it was observed at the top of a high knob, as recorded in the section for Houston Run, page 91.

THORNTON FIRE CLAY.

The Thornton Fire Clay of White[6], occurring just below the Mahoning Coal, was observed at a few localities in Webster, but is apparently of little or no commercial importance. In Hacker Valley District it was noted along the ridge road at the Pleasant View School, 1.8 miles south of Wildcat, where it is 5 feet thick and plastic, its elevation being 1770′ B. In the section for Cleveland, page 69, it is reported as occurring near the top of the mountain in the edge of Upshur north of the village, its thickness not being recorded. In the section for Houston Run, Holly District, published on page 91, its presence is noted at the top of the mountain, showing both plastic and flint clay.

LOWER MAHONING SANDSTONE.

The Lower Mahoning Sandstone of H. D. Rogers and White[7], occurring just below the Thornton Fire Clay, may be observed at various points in northwestern Webster, as it is the main remnant of the Conemaugh in that region. It is coarse and massive, gray or light-brown in color, varying from 30 to 60 feet in thickness and frequently carrying large quartz pebbles. In Chapter IV it is noted in the sections for Palmer, Holly, Houston Run, Missouri Creek, Wainville, Boggs, and Skyles. Although physically well adapted for massive masonry work, the ledge has not been quarried in Webster, owing to its position in the tops of the high ridges where it is not easily accessible.

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[6]I. C. White, Vol. II, W. Va. Geol. Survey, pp. 322-323; 1903.

[7]I. C. White, Vol. II, W. Va. Geol. Survey, p. 305; 1903.

PLATE IX.—Elk River at "Cat Hole" west of Webster Springs; Topography of Pottsville and Mauch Chunk Series.

UFFINGTON SHALE.

The Uffington Shale of White[8], coming between the Lower Mahoning Sandstone and the Upper Freeport Coal, and being the basal member of the Conemaugh Series, was noted at a few points in northwestern Webster, although it is not prominent. It is usually dark-gray or brown, and siliceous, carrying numerous plant fossils, typical of its occurrence in Monongalia County where it was named. In Chapter IV, it is noted in the sections for Wheeler, Houston Run, and Skyles. From an economic standpoint this shale has little value.

GENERAL ACCOUNT AND SECTION, ALLEGHENY SERIES.

The Allegheny Series of the Pennsylvanian Rocks, described and named by the First Geological Survey of Pennsylvania from its occurrence along the river of the same name in that State, outcrops over a considerable area in northern and northwestern Webster. As shown by Map II it is mainly confined to the high ridges and seldom touches drainage except at the heads of streams. The series begins with the top of the Upper Freeport Coal and extends down to the top of the Homewood Sandstone of the Pottsville, being from 250 to 300 feet thick and composed largely of gray sandstones and gray shales which weather to a yellow sandy soil. Besides several small coal seams of no economic importance the series contains four minable beds, one of which, the Lower Kittanning (No. 5 Block), has been opened at frequent points for local domestic use. There are no limestones or iron ores of economic importance although both occur in connection with some of the shales, but there are occasional beds of flinty or plastic fire clay under some of the coals, some of which may prove to be of eventual value, much limited by their lenticular occurrence. Lithologically the series contains approximately 75 per cent. of sandstone, 18 per cent. of shale or

[8]I. C. White, Vol. II, W. Va. Geol. Survey, p. 323; 1903.

fire clay, 10 per cent. of coal, and 2 per cent. of impure and siliceous limestone.

The following general section, compiled from the measured sections published in Chapter IV, as well as from numerous other detailed observations, shows the Allegheny Series for Webster County:

General Section of the Allegheny Series for Webster County.

	Thickness Feet	Total Feet	
Coal, Upper Freeport, medium-soft, usually multiple-bedded	0 to 5	5	5′
Fire clay, Bolivar	0 to 5	10	
Limestone, Upper Freeport, sometimes replaced by iron ore	0 to 2	12	
Sandstone, Upper Freeport, massive, gray, usually conglomeratic, with large quartz pebbles	50 to 66	78	
Coal, Lower Freeport (seldom found)	0 to 2	80	75′
Fire clay and shale, sandy, with occasional lenses of iron ore, Lower Freeport	10 to 15	95	
Sandstone, Lower Freeport, massive, coarse, gray	25 to 30	125	
Coal, Upper Kittanning "Rider" (not found in Webster)	-- ----	------	
Coal, Upper Kittanning, medium-soft, multiple-bedded	2 to 5	130	50′
Fire clay, Upper Kittanning, flinty (not often found)	0 to 5	135	
Sandstone, Upper East Lynn, massive or current-bedded, grayish-brown	20 to 60	195	
Coal, Middle Kittanning, multiple-bedded, medium-hard	0 to 5	200	70′
Sandstone, East Lynn, massive, gray or brown, coarse	20 to 50	250	
Coal, Lower Kittanning (No. 5 Block of Kanawha Valley), multiple-bedded, has both hard and soft layers	5 to 10	260	60′
Fire clay, Lower Kittanning (seldom found)	0 to 5	265	
Limestone, Vanport, ferriferous (seldom found)	0 to 5	270	
Sandstone, Kittanning (frequently absent)	0 to 17	287	
Coal, Clarion, (frequently absent)	0 to 3	290	30′
Shales, gray	0 to 10	300	
Sandstone, Homewood, (top of Pottsville)	-- ----	------	

DESCRIPTION OF MEMBERS, ALLEGHENY SERIES.

UPPER FREEPORT COAL.

The Upper Freeport Coal, of the First Geological Survey of Pennsylvania, lying at the top of the Allegheny Series, was noted at various points in northwestern Webster, but owing to its position well up toward the top of the ridges it has been prospected but little. Its bed section differs to some extent from that found in northern West Virginia, but the character of the coal is much the same, being usually medium-soft, multiple-bedded, and of the typical coking quality. Its areal extent, character, thickness, and chemical quality, together with detailed bed sections, will be discussed in Chapter X, under the subject of "Commercial Coal," and the outcrop of its supposed minable extent is delineated on Map II.

BOLIVAR FIRE CLAY.

The Bolivar Fire Clay, first described and named by Pennsylvania geologists from its occurrence near the town of that name in Westmoreland County, Pa., and belonging just under the Upper Freeport Coal, was not noted in typical character in Webster, being represented usually by only a few feet of sandy shale.

UPPER FREEPORT LIMESTONE AND IRON ORE.

The Upper Freeport Limestone, named by the First Geological Survey of Pennsylvania from its occurrence in the same locality as the Freeport Coals, was not noted in Webster, but the iron ore which often accompanies or replaces it is recorded in the section for Cleveland, page 69, where it occurs in nodular form, bedded in gray, sandy shale. It is possible that this stratum of ore might be found at other localities in the high ridges where its horizon belongs but it is not likely that it occurs in minable quantity.

UPPER FREEPORT SANDSTONE.

The Upper Freeport Sandstone, named by Pennsylvania geologists from its occurrence in that State, and usually belonging only a few feet below the Upper Freeport Coal, is a

massive, cliff-forming horizon in Webster, its prevailing color being gray. It is often 50 to 75 feet thick and as a rule contains numerous quartz pebbles, one-half inch or more in diameter. In Chapter IV it was noted in the measured sections for Wheeler, Palmer, Jumbo, Laurel Fork of Holly, Houston Run, Erbacon, Missouri Creek, Wainville, Boggs, Skyles, and Camden-on-Gauley. On Long Run of Left Fork of Holly River, 1.3 miles northwest of Pugh, it is a massive, pebbly formation, having an elevation of 2005′ B. In the ridge north of Missouri Creek, Glade District, it is a great cliff rock, 40 feet thick, capping the ridge one mile west of Erbacon. At the Locust Knob triangulation point, one mile northeast of Arcola, it is a massive, pebbly formation, capping the knob, 30 feet of it being visible. So far as known it has not been quarried in the county and its pebbly character would preclude its use except for massive masonry where large rough blocks are desired.

LOWER FREEPORT COAL.

The Lower Freeport Coal, of the First Geological Survey of Pennsylvania, belonging just under the Upper Freeport Sandstone, and coming at an interval of 60 to 80 feet below the Upper Freeport Coal in Webster, is not well developed, being seldom more than two feet thick and often represented by nothing more than a streak of black slate. It may furnish a limited amount of local fuel in a few places but may be disregarded as a commercial possibility.

At Exposure No. 15 on Map II, the blossom of the coal was observed along the ridge road, 0.3 mile northeast of Replete, Hacker Valley District, its elevation being 1750′ B. In the same district it was noted at **Exposure No. 16 on Map II**, on Left Fork of Holly River, one-half mile northwest of Wheeler, its thickness being reported 1′ 6″, with an elevation of 1950′ L., as recorded in the section for Wheeler, page 73, In Holly District it was noted at **Exposure No. 17 on Map II**, on Houston Run, 2.8 miles southeast of Centralia, where, according to Capt. Halberstadt, a thickness of 0′ 9″ was found, its elevation being 2009′ B., as exhibited in the section for Houston Run, page 91. In the same district its blossom

was also reported by Mr. Lemley on the mountainside north of the mouth of Gulf Run at an elevation of 2055′ B., its thickness being unknown.

LOWER FREEPORT LIMESTONE AND IRON ORE.

The Lower Freeport Limestone, of the Pennsylvania geologists, was not noted in Webster, but in the adjoining county of Braxton its accompanying iron ore is reported by Hennen[9], as being frequently present in the form of thin lenses of hollow kidney ore, the same being recorded in the section for Palmer, published on page 76 of this Report. It seems probable that the same formation might be uncovered by prospecting at the proper horizon in northwestern Webster, but its possible commercial value would be very small.

LOWER FREEPORT SANDSTONE.

The Lower Freeport Sandstone, of Lesley and White, named from its occurrence in the vicinity of Freeport, Pa., where it is often separated into two divisions by the Upper Kittanning Coal with its accompanying shales, was noted at numerous points in northwestern Webster. For reasons already given in recent Reports of the Survey[10] the name "Lower Freeport Sandstone" is limited in this Report to the upper division of the ledge, being that portion which belongs between the Lower Freeport and Upper Kittanning Coals. In Webster it is a massive, coarse, gray stratum, 25 to 50 feet in thickness, frequently forming cliffs, and being usually noticeable at its proper horizon. In Chapter IV it is noted in the sections for Cleveland, Pugh, Palmer, Diana, Jumbo, Tracy, Missouri Creek, Wainville, Boggs, Skyles, and Camden-on-Gauley. On Bear Run of Left Fork of Holly, one mile northwest of Poling, it was noted in the public road, being 25 feet thick and having an elevation of 1760′ B. So far as known it has not been quarried in the county but its massive bedding and comparative freedom from pebbles would

[9]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, p. 234; 1917.

[10]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, p. 234; 1917; D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, p. 249; 1918.

make it adaptable for structures where durability rather than beauty of texture is desired.

The Upper Kittanning "Rider" Coal, of Hennen[11], coming just under the Lower Freeport Sandstone, and sometimes being one foot or more in thickness in western Braxton and Clay Counties, was not observed in Webster.

UPPER KITTANNING COAL.

The Upper Kittanning Coal, of White, Platt and Lesley, named from its occurrence near the town of Kittanning, Pa., and usually coming only a few feet below the Lower Freeport Sandstone, occurs in considerable quantity in northwestern Webster where its horizon is found. It varies from 2 to 5 feet in thickness, being usually multiple-bedded and medium-soft in character, and having been opened at various points for local domestic use for which it has proved to be satisfactory. Its areal extent, character, thickness, and chemical quality, together with detailed bed sections, will be discussed in Chapter X, under the subject of "Commercial Coal", and the outcrop of its supposed minable extent is delineated on Map II.

UPPER KITTANNING FIRE CLAY.

The Upper Kittanning Fire Clay of Hennen[12], coming at its type locality, along the Monongalia-Preston line, just under the Upper Kittanning Coal, was noted at several points in northwestern Webster, usually containing both flint and plastic layers. In Hacker Valley District it was noted along a trail at the head of Buffalo Run of Little Kanawha River, 2.3 miles southeast of Cleveland, at an elevation of 2055′ B., its flinty blossom being exposed along the hillside. It was noted again along the mountain road north of Left Fork of Holly, 2.8 miles east of Hacker Valley, where, at an elevation of 2470′ B., it is two feet thick and flinty. In the same district and drainage basin, it crops along a private road, 0.4 mile

[11]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, p. 235; 1917.

[12]Ray V. Hennen, Monongalia-Marion-Taylor Report, W. Va. Geol. Survey, p. 344; 1913.

northwest of Pugh, where it is 10 feet thick and plastic, as exhibited in the section for Pugh, page 74, its elevation being 2040′ B. In Holly District it was observed in the public road near the top of Hodam Mountain, 1.6 miles north of Jumbo, where it is two feet thick and flinty, as recorded in the section for Jumbo, page 82, its elevation being 2531′ L. At all of these localities it has the appearance of a clay adapted for fire-brick or other refractory material and a greater thickness than the surface blossom would likely be found by prospecting, but its occurrence only in the high ridges would make its utilization costly.

UPPER EAST LYNN SANDSTONE.

The Upper East Lynn Sandstone of Hennen[13], occupying most of the interval between the Upper Kittanning and Middle Kittanning Coals, and probably representing the horizon formerly termed the Lower Division of the Lower Freeport Sandstone, is a prominent stratum in northwestern Webster where its horizon is found. As a rule it is a massive, cliff-forming horizon, gray or light-brown in color, and frequently carrying quartz pebbles, its thickness varying from 20 to 60 feet.

In **Hacker Valley District** its outcrop is general along Right Fork of Little Kanawha River and Left Fork of Holly, being well up toward the crest of the ridges along both streams. In Chapter IV it is recorded in the sections for Wildcat, Cleveland, Wheeler, and Pugh.

In **Holly District** it crops along Right Fork of Holly and on Elk River, being near the top of the sharp ridges along both streams. In Chapter IV its position and character are noted in the sections for Palmer, Marpleton, Big Run, Diana, Jumbo, and Tracy.

In **Glade District** it occurs generally along the waters of Laurel Creek and Birch River, being responsible for much of the rough topography that is typical of the upper half of the ridges along these watercourses. In Chapter IV it is noted

[13]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 237-240; 1917.

in the sections for Missouri Creek, Boggs, Skyles, and Camden-on-Gauley.

No quarries were observed in the Upper East Lynn, its general height above drainage making it difficult of access. Its massive character makes it well suited for cyclopean masonry.

MIDDLE KITTANNING COAL.

The Middle Kittanning Coal, named by Platt, White, and Chance from its occurrence between the Upper and Lower Kittanning Coals in western Pennsylvania, occurs in considerable quantity in certain portions of northwestern Webster. Its interval above the Lower Kittanning is extremely variable, the two beds being sometimes separated by only a few inches of shale or slate, making it possible to mine them in one drift, while at other points they are divided by an interval of 60 to 70 feet containing a heavy sandstone bed. As a rule the Middle Kittanning is multiple-bedded, varying from 0 to 5 feet in thickness, and in Webster it is rather high in ash. Its areal extent, character, thickness, and chemical quality, together with detailed bed sections, will be discussed in Chapter X, under the subject of "Commercial Coal," and the outcrop of its supposed minable extent is shown on Map II.

EAST LYNN SANDSTONE.

The East Lynn Sandstone of Krebs[14], named from the village of East Lynn, Wayne County, and defined as occupying most of the interval between the Upper Kittanning (North Coalburg) and Lower Kittanning (No. 5 Block) Coals, and later limited by Hennen[15] to the ledge lying between the Middle and Lower Kittanning Coals, is of wide occurrence in northwestern Webster. Its character is similar to that of the Upper East Lynn, being usually massive, gray or light-brown in color, sometimes pebbly and frequently forming cliffs, its thickness varying from 20 to 50 feet, as a rule, although it is

[14]C. E. Krebs, Cabell-Wayne-Lincoln Report, W. Va. Geol. Survey, pp. 183-184; 1913.

[15]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 241-245; 1917.

PLATE X (a).—View of Princeton Conglomerate along West Virginia Midland Railroad, 0.5 mile west of Skidmore Crossing.

PLATE X (b).—Another view of same exposure from different angle.

sometimes entirely absent owing to the thinning of the interval between the two coals.

In **Hacker Valley District** it outcrops generally along the waters of Right Fork of Little Kanawha River and Left Fork of Holly, being high up against the hillsides except near the heads of streams. In Chapter IV it is noted in the sections for Wildcat, Cleveland, and Pugh.

In **Holly District** it is found above drainage along the waters of Right Fork of Holly and on Elk River, being well up toward the summits of the ridges. In Chapter IV it is recorded in the sections for Palmer, Big Run, Diana, Jumbo, Laurel Fork of Holly, McCourt Ford, and Houston Run.

In **Glade District** it is near the tops of the ridges along the waters of Laurel Creek and Birch River, its position in the measures being exhibited in the sections for Erbacon, Missouri Creek, Wainville, and Boggs, published in Chapter IV.

No quarries were observed on this ledge as its position in the hills makes it difficult of access. It is mainly suited for rough masonry work where large blocks are desired.

LOWER KITTANNING (NO. 5 BLOCK) COAL.

The Lower Kittanning Coal, named by J. P. Lesley from its occurrence in Arinstrong County, Pa., and later termed the **No. 5 Block** by White[15] from its occurrence in the Great Kanawha Valley in the vicinity of Montgomery, Fayette County, W. Va., where it had long been mined under that name, is an important and valuable seam in northwestern Webster. The true position of the No. 5 Block Coal in the Allegheny Series has long been a subject of some doubt among geologists and mining engineers, but in Volume II(A), Dr. White states his conclusion that the Roaring Creek Coal of Randolph County (now fully determined to be the Lower Kittanning) can be traced across Nicholas, Braxton, and Clay Counties, through a chain of local coal banks, to the Great Kanawha River in Fayette and Kanawha Counties, where it has been mined under the name of No. 5 Block. This

[15] I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 525-528; 1908.

early conclusion seems now to be fully confirmed by later studies. The writer has traced it across Randolph, Upshur and Lewis, the results of which have been published[16], and through Webster (territory of the present Report), and through northern Nicholas (to be published later) to the Clay County line in the vicinity of Widen. From the Clay-Nicholas line it has been traced by Hennen through Clay and Fayette to the Great Kanawha River, the results having been already published[17]. Since this immense amount of work has removed all reasonable doubt as to the identity of the No. 5 Block with the Lower Kittanning and since the latter name deserves precedence because of priority, the early title will be given first place in this Report.

The Lower Kittanning (No. 5 Block) Coal in Webster occurs just under the East Lynn Sandstone, and at a varying interval of 10 to 50 feet above the top of the Homewood Sandstone, its usual interval above the Eagle Coal being 550 feet. It varies in thickness from 4 to 10 feet, being nearly always multiple-bedded and of the soft coking type. Its areal extent, character, thickness, and chemical quality, together with detailed bed sections, will be discussed in Chapter X, under the subject of "Commercial Coal," and the outcrop of its supposed minable extent is shown on Map II.

LOWER KITTANNING FIRE CLAY.

The Lower Kittanning Fire Clay, of White, coming just under the Lower Kittanning Coal, has a wide distribution in Pennsylvania and Ohio, and is also mined extensively in Hancock County, West Virginia, but in Webster it is seldom found. In Chapter IV its presence is noted in the section for Missouri Creek, page 109, where it is 5 feet thick and plastic, and in that for Skyles, page 112, where it is apparently about five feet thick at its outcrop on the mountain north of the village,

[16]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, pp. 261 and 551-640; 1918; and Lewis and Gilmer Report, W. Va. Geol. Survey, pp. 164 and 579-590; 1916.

[17]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 245-246 and 623-681; 1917; and Fayette Report, W. Va. Geol. Survey, pp. 228-9 and 461-9; 1919.

being plastic and somewhat sandy. It offers little possibility of commercial exploitation.

VANPORT (FERRIFEROUS) LIMESTONE.

The Vanport (Ferriferous) Limestone, belonging just under the Lower Kittanning Fire Clay, and carrying marine fossils in Ohio and western Pennsylvania, is found but seldom in central West Virginia. In Webster a limestone at this horizon was noted on the waters of Birch River, 1.2 miles northeast of Boggs, where it crops in the public road just below an opening in the Lower Kittanning Coal, there being nodules of ferruginous limestone bedded in 20 feet of shale. No fossils were observed but a careful search was not made.

The Kittanning Sandstone of White[18], named from the fact that it underlies the Lower Kittanning Coal only a short interval at its type locality in western Pennsylvania, was not observed in Webster although there is often an interval of 20 to 40 feet between the Lower Kittanning Coal and the base of the Allegheny Series, in which it may occur.

CLARION COAL.

The Clarion Coal, so named by the First Geological Survey of Pennsylvania from the town of that name is of slight occurrence and of no probable commercial value in Webster. On Left Fork of Holly River its blossom was noted on the mountain just south of the mouth of Laurel Fork, as recorded in the section for that point, page 85, its elevation being 2355′ B. At **Prospect No. 135 on Map II,** on Houston Run of Elk, 2.8 miles southeast of Centralia, it was found to be 0′ 8″ thick, at an elevation of 1824′ B., being 21 feet below the Lower Kittanning. At **Prospect No. 136 on Map II,** on Laurel Creek, 1.2 miles southeast of Prestonia, an opening was once made at its horizon but only a streak of coal was found, its elevation being 1660′ B., and its interval below the Lower Kittanning Coal 30 feet. At **Prospect No. 137 on Map II,** on Laurel Creek, one-half mile south of Erbacon, it is 2′ 10″ thick with a shale parting, as recorded in the section for that village, page 108, its elevation being 2005′ B., and its interval below the Lower Kittanning Coal 50 feet.

[18] I. C. White, Bull. No. 65, U. S. Geol. Survey, p. 172; 1891.

CHAPTER VI.

STRATIGRAPHY, KANAWHA GROUP OF THE POTTSVILLE SERIES.

GENERAL ACCOUNT AND SECTION OF POTTSVILLE.

The Pottsville Series was first named and described by Pennsylvania geologists from its occurrence at Pottsville, eastern Pennsylvania, where it has numerous beds of conglomeratic sandstones, separated by anthracite coal seams. Later it was subdivided by Dr. I. C. White into the Upper Pottsville, or Kanawha Group, the Middle Pottsville, or New River Group, and the Lower Pottsville, or Pocahontas Group. Of these titles custom has sanctioned the use of the geographic names last mentioned for each subdivision on account of the close application of the Kanawha and New River to the coal fields of southern West Virginia and of the Pocahontas to the field of that name in southwestern Virginia and southern West Virginia, and for that reason they will be used exclusively in this Report. Of the above-named groups, the Pottsville Series is represented in Webster only by the Kanawha and New River, the Pocahontas type of coals and their accompanying sandstones and shales not being found so far north in the State. The Pottsville covers a large proportion of the surface of the county, as outlined on Map II, making an extremely rough topography. A physical description of each group will be given under its proper heading in subsequent pages.

The following general section has been compiled to show the full development of the Pottsville Series in Webster. By way of introduction it may be said that Webster occupies a position midway between the Pennsylvania State Line, where the Pottsville is only about 250 feet thick, and the Virginia

State Line, adjoining McDowell County, where the Kanawha and New River Groups exhibit a maximum thickness of 3130 feet. In contrast with these two extremes the Kanawha and New River of Webster have a total thickness of 1600 feet, containing many coals, sandstones, and other members not known at all in the minimum phase of northern West Virginia and western Pennsylvania, but on the other hand, lacking several of the great coal beds of southern West Virginia, as well as many of the great sandstone ledges and fossiliferous limestones and shales. Owing to the fact that geologic study of the Pottsville was undertaken first in Pennsylvania, followed by an almost entirely distinct classification in southern West Virginia in the region of maximum thickness, with a nomenclature of its own, made necessary because of the fact that none of the Pennsylvania formations had then been definitely traced through the central counties of West Virginia, it has been necessary in the present volume to recognize two distinct titles for several important horizons the identity of which now seems subject to little further doubt. Precedence is given to the Pennsylvania nomenclature in those members coming above the Kanawha Black Flint because of their general use in the many Reports of that State. Below and including the Black Flint the nomenclature of southern West Virginia has been employed because of the overwhelming amount of geologic and commercial literature that contains these titles, the older Pennsylvania names being given in parentheses.

Attention is further called to the fact that all members of the Kanawha and New River Groups heretofore recognized in previous publications have been included in the general section published below, with the statement following several of them that they were not observed in Webster. It is quite certain that several of these members do not exist in Webster but it is equally likely that a number of them will eventually be found within the county when close drilling or prospecting has finally been done over wide areas that are now covered with dense forest growth and have been scarcely explored. It is believed that the listing of these members at their proper

places in the general section will greatly aid in whatever search may be made for them in the future.

By referring to the measured sections published in Chapter IV it may be noted that many of the various Pottsville sandstone ledges frequently have a much greater thickness than the maximum noted in the general section below, this apparent discrepancy being due to the fact that the individual members frequently develop local lenses, usually compensated by a corresponding thinning of others above or below them. To have incorporated these excessive thicknesses in the general section would have distorted the prevailing intervals between important coals.

General Section of the Pottsville Series for Webster County.

Kanawha Group (950')	Thickness Feet	Total Feet	
Sandstone, Homewood, massive, gray, sometimes pebbly, prominent in northern portion of county	25 to 75	75	
Coal, Upper Mercer (Stockton "A"), lenticular, frequently found in northern portion of county	0 to 5	80	80'
Shale, sandy or dark, with lenticular sandstones	30 to 75	155	
Kanawha Black Flint (Mercer Limestone of Pa.?), dark shale, frequently carrying marine fossils	0 to 5	160	
Coal, Stockton (Lower Mercer of Pa.), multiple-bedded, usually medium-soft, with splinty layers	2 to 5	165	85'
Fire clay shale	0 to 5	170	
Sandstone, Upper Coalburg (Upper Connoquenessing of Pa.)	20 to 40	210	
Coal, Quakertown "Rider" (not observed in Webster)	0	210	
Black slate, Quakertown (not observed in Webster)	0	210	
Coal, Coalburg (Quakertown "Rider"?), multiple-bedded, with soft and splinty layers	2 to 10	220	55'
Fire clay, impure, and sandy shale	0 to 10	230	
Coal, Little Coalburg, (not observed in Webster)	0	230	
Sandstone, Lower Coalburg, (not observed in Webster)	0	230	
Coal, Buffalo Creek (not observed in Webster)	0	230	
Limestone, Buffalo Creek, (not observed in Webster)	0	230	

	Thickness Feet	Total Feet	
Sandstone, Upper Winifrede, massive, gray	10 to 26	256	
Coal, Winifrede, (Quakertown? of Pa.), single- or multiple-bedded, both soft and splinty layers	0 to 4	260	40′
Fire clay, impure, and sandy shale	5 to 10	270	
Coal, Lower Winifrede (not observed in Webster)	0	270	
Sandstone, Lower Winifrede, massive, gray	5 to 15	285	
Coal, Chilton "A" (not observed in Webster)	0	285	
Limestone, Winifrede, nodular, often represented only by dark shale, both sometimes containing non-marine fossils	0 to 5	290	
Sandstone, Upper Chilton, massive, gray	5 to 16	306	
Coal, Chilton "Rider" (not observed in Webster)	0	306	
Coal, Chilton, medium-soft	0 to 4	310	50′
Fire clay, impure, and sandy shale	0 to 5	315	
Sandstone, Lower Chilton, massive, gray	5 to 15	330	
Coal, Little Chilton, (not observed in Webster)	0	330	
Sandstone, Hernshaw (not observed in Webster)	0	330	
Coal, Hernshaw, (not observed in Webster)	0	330	
Sandstone, Naugatuck, (not observed in Webster)	0	330	
Coal, Dingess, (not observed in Webster)	0	330	
Sandstone, Williamson, (not observed in Webster)	0	330	
Limestone, Dingess, gray and hard, sometimes brown and siliceous, with marine fossils in Nicholas and other counties to southwest (not observed in Webster, but probably present)	0	330	
Coal, Williamson, (not observed in Webster)	0	330	
Sandstone, Upper Cedar Grove, massive, gray	5 to 16	346	
Limestone, Seth, nodular, occurring in sandy shale, sometimes containing marine fossils (not observed in Webster)	0	346	
Coal, Cedar Grove, medium-hard, with cannel slate roof, mined at Summit Station on West Virginia Midland R. R.	2 to 4	350	40′
Fire clay, impure, and shale	0 to 5	355	

	Thickness Feet	Total Feet	
Sandstone, Middle Cedar Grove, shaly	0 to 8	363	
Coal, Lower Cedar Grove, not often found	0 to 2	365	15′
Sandstone, Peerless, same as Lower Cedar Grove, massive, gray	10 to 17	382	
Coal, Alma "A" (not observed in Webster)	0	382	
Coal, Alma, medium-soft	0 to 3	385	20′
Fire clay, impure, and shale	0 to 5	390	
Sandstone, Monitor, massive, gray, same as Logan	0 to 15	405	
Coal, Little Alma, (not observed in Webster)	0	405	
Sandstone, Lower Monitor	0 to 15	420	
Limestone, Campbell Creek, dark-gray, lenticular, (seldom found in Webster)	0 to 1	421	
Coal, Campbell Creek (Peerless Bench) soft, single-bedded, mined commercially on Laurel Creek at Arcola, and prospected at various points on Holly River where it is usually cannel	2 to 4	425	40′
Fire clay, impure, and sandy shale	10 to 22	447	
Coal, Campbell Creek (No. 2 Gas Bench), soft	0 to 3	450	25′
Fire clay, impure, and sandy shale	5 to 10	460	
Sandstone, Lower Campbell Creek (not observed in Webster)	0	460	
Coal, Lower Campbell Creek (not observed in Webster)	0	460	
Sandstone, Brownstown, massive, gray, often forming cliffs or cataracts	20 to 50	510	
Coal, Powellton, "A," lenticular	0 to 2	512	62′
Shale, sandy	2 to 6	518	
Coal, Powellton, soft	1 to 2	520	8′
Fire clay, impure, and sandy shale	0 to 5	525	
Limestone, Stockton, hard, lenticular	0 to 1	526	
Coal, Matewan (not observed in Webster)	0	526	
Sandstone, Matewan (not observed in Webster)	0	526	
Coal, Eagle "A" (not observed in Webster)	0	526	
Sandstone, Eagle, gray, massive	10 to 15	541	
Limestone and shale, Newlon, dark, argillaceous and limy, frequently replaces lower portion of Eagle Sandstone	10 to 5	546	
Coal, Eagle, medium-soft, with occasional hard layers, and usually containing a slaty or bony parting near top; mined commercially on Oldlick Creek, and prospected generally on Holly River and Laurel Creek	3 to 4	550	30′

	Thickness Feet	Total Feet	
Fire clay, impure, and sandy shale	0 to 5	555	
Sandstone, Bens Creek (not observed in Webster)	0	555	
Coal, Bens Creek (not observed in Webster)	0	555	
Sandstone, Decota, massive, gray, frequently forms cliffs or cataracts	10 to 35	590	
Shale, dark	0 to 9	599	
Coal, Little Eagle, soft	0 to 1	600	50'
Shale, sandy, dark	10 to 18	618	
Coal, Cedar, soft	0 to 2	620	20'
Sandstone, Grapevine, massive, gray	0 to 20	640	
Shale, with nodular limestone, Eagle, dark, argillaceous, with brackish or non-marine fossils	10 to 20	660	
Coal, Little Cedar, soft	0 to 1	661	41'
Shale, dark, laminated	10 to 14	675	
Sandstone, Lower War Eagle, massive, gray	10 to 23	698	
Coal, Lower War Eagle, soft, often slaty	0 to 2	700	39'
Fire clay, impure, and shale	5 to 10	710	
Sandstone, Upper Gilbert, (not noted in Webster)	0	710	
Limestone, Oceana, (not observed in Webster)	0	710	
Coal, Glenalum Tunnel (not observed in Webster)	0	710	
Sandstone, Lower Gilbert, massive, gray, very hard, often making great cliffs or cataracts	30 to 80	790	
Coal "Gilbert" "A" (not observed in Webster)	0	790	
Shale, Gilbert, dark, laminated	0 to 4	796	
Coal, Gilbert, soft, columnar	2 to 4	800	100'
Shale, sandy	0 to 19	819	
Sandstone, Dotson, massive, gray	20 to 65	884	
Coal, Douglas "A"	0 to 1	885	85'
Shale, sandy, dark	5 to 13	898	
Coal, Douglas, often slaty	0 to 2	900	15'
Sandstone, Lower Dotson, massive, gray	10 to 25	925	
Shale, Douglas, dark, sandy, laminated	5 to 13	938	
Coal, Lower Douglas, soft, often slaty	0 to 2	940	40'
Shale, gray and sandy	0 to 10	950	
New River Group (650')			
Sandstone, Upper Nuttall, massive, gray, and sometimes pebbly, frequently forming cliffs in the Gauley drainage basin	30 to 80	1030	
Coal, Iaeger "B" (not observed in Webster)	0	1030	
Shale, sandy	10 to 20	1050	

	Thickness Feet	Total Feet	
Sandstone, Lower Nuttall, massive, gray or brown, frequently pebbly, and forming cliffs in the Gauley drainage basin	50 to 90	1140	
Coal, Iaeger "A" (not observed in Webster)	0	1140	
Shale, Upper Iaeger, argillaceous, laminated	5 to 21	1161	
Coal, Hughes Ferry (Iaeger of McDowell County), soft, columnar, mined by W. R. Cogar and others near Skelt	2 to 4	1165	215′
Fire clay, impure, and dark shale	0 to 4	1169	
Sandstone, Middle Iaeger, massive, gray, medium-coarse	5 to 20	1189	
Coal, Lower Iaeger, soft, lenticular	0 to 1	1190	25′
Sandstone, Lower Iaeger, (not observed in Webster)	0	1190	
Shale, Lower Iaeger, dark, argillaceous, laminated	0 to 5	1195	
Sandstone, Harvey Conglomerate, massive, gray, coarse, hard, sometimes pebbly	20 to 35	1230	
Shale, Sandy Huff, dark, argillaceous, laminated	0 to 8	1238	
Coal, Castle, soft, columnar	1 to 2	1240	50′
Shale, dark	0 to 7	1247	
Sandstone, Guyandot, massive, gray, coarse very hard, sometimes makes cliffs	25 to 35	1282	
Shale, dark-gray, with marine fossils. Skelt	0 to 5	1287	
Coal, Sewell "B," soft, columnar	0 to 3	1290	50′
Coal, Sewell "A" (not observed in Webster)	0	1290	
Sandstone, Lower Guyandot, massive, gray, medium-coarse and very hard	10 to 35	1325	
Shale, Hartridge, dark, argillaceous, and laminated, with iron carbonate lenses, plant fossils, and sometimes carrying marine fossils, (Lingula)	5 to 20	1345	
Coal, Sewell, (Sharon of Pa.), soft columnar, usually single-bedded, generally found in Elk, Gauley, Williams, and portions of Cranberry drainage basins	2 to 5	1350	60′
Shale, gray, sandy	0 to 11	1361	
Sandstone, Welch, massive, gray, coarse	10 to 35	1396	
Coal, Welch, soft, columnar, single-bedded	0 to 4	1400	50′
Shale, sandy	5 to 20	1420	
Sandstone, Upper Raleigh (Sharon of Pa.), massive, gray, often pebbly	40 to 70	1490	

	Thickness Feet	Total Feet	
Coal, Little Raleigh "A" (not observed in Webster)	0	1490	
Coal, Little Raleigh, streak, seldom found	....	1490	90′
Sandstone, Lower Raleigh, (not observed in Webster)	0	1490	
Shale, sandy	0 to 22	1512	
Coal, Beckley "Rider" (not observed in Webster)	0	1512	
Coal, Beckley, slaty, observed at a few points on Gauley River	0 to 3	1515	25′
Shale, sandy	0 to 5	1520	
Sandstone, Quinnimont, lenticular, seldom found	0 to 20	1540	
Shale, Quinnimont, dark, argillaceous, laminated	0 to 12	1552	
Coal, Fire Creek, multiple-bedded, medium-hard, usually absent but showing good thickness at Bolair on Gauley and Dogway on Cranberry	0 to 8	1560	45′
Shale, sandy	5 to 10	1570	
Coal, Little Fire Creek, (not observed in Webster)	0	1570	
Sandstone, Pineville, coarse, gray, massive, noted on Cranberry River	0 to 30	1600	
Mauch Chunk Red Shales	.. ....	.....	

GENERAL DESCRIPTION, KANAWHA GROUP.

The Kanawha Group of White[1], composing the upper portion of the Pottsville Series, and having a maximum thickness of 950 feet in Webster, consists mainly of massive, gray sandstone beds, varying from 10 to 100 feet in thickness, separated by deposits of sandy or carbonaceous shale, with coal seams usually appearing somewhere between the successive layers of rock. Several of the shales frequently carry fossil shells and at least two of these have a distinctly marine phase. Many of the coal seams are somewhat lenticular, having a good development in some localities while in neighboring areas their development is poor, indicating much irregularity in old shore-lines of the Paleozoic sea. As defined in Webster County, the group varies in thickness from about 500 feet in the vicinity of Cleveland at the northern end of the county, to 950 feet at Camden-on-Gauley, along the southwestern

[1]I. C. White, Vol. II, W. Va. Geol. Survey, pp. 500-502; 1903.

edge, making a southwestward increase of 90 per cent. Several new coals and sandstones, not known to occur at Cleveland, become well developed in the region of the greater thickness, and certain fossiliferous shales appear in the measures that could not be found at the former locality. Most of the coals are of the medium-soft, gaseous type, but benches of semi-splint, hard coal are found in the Stockton and Coalburg beds that belong near the top of the group. Most of the gaseous coals are single-bedded and thin while those that contain splint are multiple-bedded and thick.

Lithologically the Kanawha Group contains approximately 60 per cent. of sandstone, 32 per cent. of shale, 7 per cent. of coal, and 1 per cent. of impure and siliceous limestone. The great percentage of sandstone and the lack of rich limestone combine to make an extremely poor soil.

DESCRIPTION OF MEMBERS, KANAWHA GROUP.

HOMEWOOD SANDSTONE.

The Homewood Sandstone, named by Dr. I. C. White from its outcrop in Beaver County, western Pennsylvania, and coming at the top of the Pottsville Series, is usually found in massive development wherever its horizon occurs in Webster. As a rule it is massive, gravish-white, hard and coarse, often carrying medium-sized quartz pebbles, and varying in thickness from 25 to 75 feet. Along the northwestern edge of the county its outcrop may be observed at frequent points in Hacker Valley, Holly and Glade Districts, its position being well up toward the tops of the hills, where it often makes cliffs or steep slopes. It is prominent along the mountain road 1.1 miles south of Cleveland where it makes a cliff 30 feet thick. On the Pickens and Hacker Valley public road it is prominent at several points east of Penbro. On Right Fork of Holly River it makes a great cliff, 100 feet thick, near the top of the mountain, 0.4 mile north of Salisbury Station, its basal elevation being 1718 feet. In Chapter IV its presence is noted and its character described in the sections for Wildcat, Cleveland, Arvondale Junction, Silica, Wheeler, Pugh, Palmer, Holly, Marpleton, Big Run, Diana, Jumbo, Skelt, Sum-

mit, Houston Run, Bernardstown, Erbacon, Missouri Creek, Boggs, Skyles, and Camden-on-Gauley.

So far as known it has not been quarried within the limits of the county, mainly because it is not of convenient access, there being other ledges of similar stone more convenient to drainage and transportation lines. Its physical character is such that it would make good stone for structures where cyclopean masonry is desired.

UPPER MERCER (STOCKTON "A") COAL.

The Upper Mercer Coal, of the Second Geological Survey of Pennsylvania, being apparently the same as the **Stockton "A" Coal** of Hennen[2] and coming just below the Homewood Sandstone from which it is sometimes separated by a thin bed of dark or sandy shale, is a lenticular, multiple-bedded seam, that is found at numerous points in northern Webster, where it has been mined for local domestic fuel, its thickness sometimes reaching 5 feet. Its character and areal extent, together with various detailed bed sections, will be presented in Chapter X under the subject of "Commercial Coal." Its outcrop is not shown on Map II, owing to the fact that it belongs only 30 to 75 feet above the Stockton and its position may readily be determined from that stratum.

KANAWHA BLACK FLINT.

The Kanawha Black Flint of Rogers[3], later described more fully by White[4], was named from its occurrence in the Great Kanawha Valley of West Virginia where it is a hard, black, flinty horizon, carrying marine fossils. In northwestern Webster the cherty phase of the Kanawha Valley is not found but the horizon is present, its character being that of a dark, carbonaceous or sandy shale, having a marine fauna that is abundant in some localities but by no means constant over the region of its crop. Its position in the Kanawha

[2]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 253-255; 1917.

[3]W. B. Rogers, Fifth Annual Report of Virginia; 1839.

[4]I. C. White, Bull. 65, U. S. Geol. Survey, p. 98; 1891; and Vol. II, W. Va. Geol. Survey, pp. 328-331; 1903.

Group is from 125 to 160 feet below the top of the Homewood Sandstone, and immediately above the Stockton Coal. Its position in the Pottsville column of western Pennsylvania seems now to be well established as belonging just above the **Lower Mercer Coal (Stockton** of Kanawha Valley), making it correlate with the Mercer Limestone, as long ago claimed by both Dr. I. C. White and Dr. David White, Chief Geologist of the United States Geological Survey[5], this stratum being both fossiliferous and cherty in western Pennsylvania and northeastern Ohio.

In **Hacker Valley District,** the black shale that represents the Flint horizon was observed along the public road, 0.8 mile south of Cleveland, where it comes 4 feet above the Stockton Coal which at that point has an elevation of 1640′ B. Numerous plant remains were observed and a few shell of **Naiadites,** indicating a non-marine and probably fresh-water origin. On a branch of Left Fork of Holly, 0.8 mile southwest of Replete it is present in the form of black slate 1′ 6″ thick, coming just above the Stockton Coal which at that point has an elevation of 1510′ B. On Bear Run of the same stream it has the same character with a thickness of 1 foot, coming just over the Stockton Coal whose elevation is 1530′ B. On Left Fork of Holly, 0.4 mile northeast of Poling, it is visible just over the Stockton Coal, the elevation of which is 1610′ B. Here it contains non-marine? fossils, **Naiadites, Spirorbis,** and ostracods being noted.

In **Holly District** it was observed on Blaze Fork of Oldlick Creek, 2.1 miles southwest of Poling, where it was noted as a black slate, 2 feet thick, coming just over the Stockton Coal, the elevation of which is 1590′ B. On Right Fork of Holly it was noted in the steep mountainside, 0.4 mile north of Salisbury Station, where it occurs as a black slate bearing marine fossil shells and coming just over a prospect in the Stockton Coal, the elevation of which is 1715′ B. On a branch of Grassy Creek, 0.6 mile north of Kovan, it is present in the form of black shale coming just over an opening in the Stockton, the elevation of which is 2270′ B. The impression of an

[5]I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 487-488; 1908.

oval fruit or nut with a polished surface was found in the shale. At another point on Grassy Creek, 0.8 mile north of Summit Station and on the steep mountainside just west of the West Virginia Midland R. R., it was found in the form of dark, sandy shale, coming just over a prospect in the Stockton Coal, the elevation of which is 2010′ B. At this point it contains an abundant fauna of finely preserved marine shells, a large collection having been secured through the courtesy of Col. John T. McGraw who made the prospect and on whose special car the collection was hauled to local headquarters at Webster Springs. Another very interesting exposure was noted high up against the steep mountainside south of Elk River, 1.2 miles southwest of Tracy Switch, where it appears as a black slate, 5 feet thick, coming just over the Stockton Coal, whose elevation is 2340′ B. At this point many distinct marine shells were observed. **Orbiculoidea** being prominent. On Laurel Creek, 1.2 miles southeast of Prestonia, it was noted again above a prospect in the Stockton Coal, the elevation of which is 1545′ B., having the form of black slate, 3 feet thick, and containing marine fossils, among which **Orbiculoidea** was noted.

In **Glade District** the Flint was noted at the head of a branch of Barnet Run of Birch River, 1.9 miles southwest of Boggs, at the Webster-Nicholas line, where it occurs in the form of black and sandy shale, 5 feet thick, coming just over the Stockton Coal, the elevation of which is 2070′ B., and containing many well-preserved fossils, **Lingula, Orbiculoidea,** and **Schizodus** being noted.

STOCKTON (LOWER MERCER) COAL.

The **Stockton Coal** of White[6], named from Aaron Stockton who once mined it at the town of Cannelton, Kanawha County, coming just under the Kanawha Black Flint and 130 to 165 feet below the top of the Homewood Sandstone, is a widely prevalent and valuable seam in Webster. As a rule it is multiple-bedded, from 2 to 5 feet in thickness, having both soft and splinty layers, with one or two partings of dark

[6]I. C. White, Vol. II, W. Va. Geol. Survey, p. 583; 1903.

shale or slate. As previously stated by the writer[7], the Stockton quite evidently correlates with the **Lower Mercer** of the Pennsylvania classification, since the Kanawha Black Flint fossils have been identified in southern Upshur, coming just above the latter coal, from which region northward its correlation with the Pennsylvania measures is not subject to serious doubt.

The outcrop of the Stockton Coal is shown in detail on Map II in those regions of northwestern Webster where it is known or believed to be of minable thickness. Its character and areal extent, together with detailed bed sections, will be presented in Chapter X under the subject of "Commercial Coal."

UPPER COALBURG (UPPER CONNOQUENESSING?) SANDSTONE.

The Coalburg Sandstone of White[8], later termed the **Upper Coalburg Sandstone** by Hennen and the writer[9], coming a few feet under the Stockton Coal, is present generally throughout northern Webster where its horizon occurs, being 20 to 40 feet thick, medium-coarse and hard. In Chapter IV its presence and character are noted in the sections for Arvondale Junction, Silica, Skelt, Missouri Creek, and Wainville. It is the belief of the writer that the Upper Coalburg Sandstone is the same as the **Upper Connoquenessing** of the Pennsylvania classification, having been first named and described by Dr. I. C White from its occurrence in Lawrence County, Pa. It is true that the Upper Coalburg in Webster does not have the conglomeratic character that is a common feature of the Upper Connoquenessing in western Randolph and other northern counties of West Virginia, that are situated in the zone of shore-line deposition, but it is a noticeable fact that in passing from the Middle Fork River region in Randolph, where the Upper Connoquenessing has its most massive and

[7]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, pp. 271 and 662; 1918.

[8]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 468; 1908.

[9]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 137-138; 1914.

conglomeratic phase found in the State, westward across Upshur, the ledge gradually loses its pebbly character, becoming finally medium-coarse and much less massive in its proportions. A further pertinent fact is that in northern Webster there are no quartz pebbles of more than local occurrence in any of the sandstones of the Kanawha Group below the Stockton Coal, the same statement holding true for these sandstones for many miles southwestward on the strike of the measures, making it necessary to accept as a fact the complete disappearance of pebbles at the Connoquenessing stage in this region, and making it seem most probable that the Upper Connoquenessing and the Upper Coalburg are the same, since they both have the same relationship to the Stockton Coal and the Kanawha Black Flint above it.

No quarries were observed on the Upper Coalburg, its character as a building stone being much the same as may be found in other ledges that crop lower in the hills and are therefore available at less expense.

The **Quakertown "Rider" Coal** and the fossiliferous **Quakertown Black Slate** of the writer[10], named from their occurrence on the Tygart Valley River at Laurel Station, Randolph County, were not observed in Webster, being apparently of rather local occurrence in the region where the Connoquenessing group is so well developed, unless, as may be possible, the Quakertown "Rider" Coal is identical with the Coalburg, as will be discussed under the description of the latter seam.

COALBURG (QUAKERTOWN "RIDER"?) COAL.

The Coalburg Coal of White[11], named from its occurrence at Coalburg, Kanawha County, where it has long been mined, and belonging in Webster 50 to 60 feet below the Kanawha Black Flint, and 200 to 220 feet below the top of the Homewood Sandstone, has been prospected at several points in the northwestern portion of the county where its horizon is pres-

[10]D. B. Reger, Barbour, Upshur and Western Randolph Report, W. Va. Geol. Survey, pp. 273-4; 1918.

[11]I. C. White, Bull. 65, U. S. Geol. Survey, p. 162; 1891; and Vol. II, W. Va. Geol. Survey, pp. 548-556; 1903.

ent. It is somewhat irregular in its occurrence, varying in thickness from 2 to 10 feet, being multiple-bedded with several seams of shale or slate, and containing both soft and splinty benches of coal. Its character and areal extent, together with detailed bed sections, will be presented in Chapter X, under the subject of "Commercial Coal," and its outcrop, where it is known or believed to be of minable thickness, is delineated on Map II.

The proper position of the Coalburg Coal in the Pennsylvania classification is uncertain since the evidence concerning it is still inconclusive. In a former Report[12] the writer has stated the belief that the Quakertown Coal of Pennsylvania belongs either at the Coalburg or Winifrede horizon, the evidence favoring the latter seam. If that supposition is true, then the Coalburg most probably correlates with the **Quakertown "Rider" Coal** of the writer[13], which at its type locality in Randolph County belongs only a few feet below the Upper Connoquenessing Sandstone. The lenticular character and almost total disappearance of the Coalburg in certain sections of northern Webster would indicate a rapid thinning northeastward and it may well be possible that the Quakertown "Rider" of Randolph is its final northern phase.

The Little Coalburg Coal of Hennen and the writer[14], the **Lower Coalburg Sandstone**[15], the **Buffalo Creek Coal** of White[16], and the **Buffalo Creek Limestone** of Hennen and the writer[17], were not observed in Webster and since the type locality of all these members is in Mingo County where the Kanawha Group is much thicker than in Webster they have probably disappeared from the measures in coming northeastward.

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[12]Barbour, Upshur and Western Randolph Report, W. Va. Geol. Survey, p. 274; 1918.

[13]Ibid., p. 273; 1918.

[14]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 140-141; 1914.

[15]Ibid., p. 141.

[16]I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 415-419; 1908.

[17]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, p. 143; 1914.

UPPER WINIFREDE SANDSTONE.

The Upper Winifrede Sandstone of White[18], coming at its type locality at Winifrede, Kanawha County, just above the Winifrede Coal, is apparently represented in Webster by a massive, gray stratum, noted and described in Chapter IV in the sections for Cleveland, Skelt, McCourt Ford, Missouri Creek, Skyles, and Camden-on-Gauley. So far as known it has not been quarried but it could be used for rough building stone if so desired.

WINIFREDE COAL.

The Winifrede Coal of White[19], named from its occurrence at Winifrede, Kanawha County, where it has been mined extensively, belongs in Webster 75 to 100 feet below the Kanawha Black Flint and 225 to 260 feet below the top of the Homewood Sandstone. It is frequently multiple-bedded, with both soft and splinty benches of coal, sometimes reaching a total of four feet, but as a rule is single-bedded, with a thickness of less than three feet. Its character and areal extent, together with various detailed bed sections, will be discussed in full in Chapter X under the subject of "Commercial Coal."

The position of the Winifrede Coal in the Pennsylvania classification is not altogether certain, but in a previous Report[20] the writer has expressed the belief that it most probably correlates with the **Quakertown Coal**, so termed by Dr. I. C. White from its occurrence at the village of that name on the Mahoning River near the Ohio-Pennsylvania State Line. In southern Upshur the Quakertown Coal belongs 150 to 200 feet below the top of the Homewood Sandstone, and 50 to 60 feet below the Kanawha Black Flint. As compared to the intervals from the same members to the Winifrede in Webster these show the amount of northward thinning that might be logically expected. In addition to the harmony of intervals

[18]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 271; 1908.

[19]I. C. White, Bull. 65, U. S. Geol. Survey, p. 162; 1891; and Vol. II, W. Va. Geol. Survey, p. 556; 1903.

[20]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, p. 274; 1918.

there is a close physical resemblance in the character of the coal which adds materially to the strength of the conclusion above reached.

In his recent Fayette County Report of the State Survey, pages 236-237, Ray V. Hennen expresses his belief that the Quakertown Coal of the Pennsylvania classification correlates with the Campbell Creek Coal of the Kanawha Valley, basing his conclusions mainly on a republished version of a portion of the Rowlesburg, Preston County, Section, measured by himself and the writer and first published in the Preston Report of the Survey, pages 97-99, certain additional data secured later by himself, Price, and the writer having been incorporated in the same. With many of the additional correlations therein named for the various Pottsville members the writer agrees, most of the same having been detailed under the description of the Pottsville in the Barbour, Upshur and Western Portion of Randolph Report, previous to the publication of the work on Fayette.

With Mr. Hennen's assumption that the Quakertown Coal of the Rowlesburg Section is the same as the Campbell Creek of the Kanawha Valley, the writer finds it impossible to agree, as he has personally traced the Campbell Creek Coal, through three years of arduous and painstaking effort, from the Fayette County Line, where its identity is unquestioned, across Nicholas, Webster, southern Upshur and northwestern Randolph to the Middle Fork River region in the vicinity of Gale and Ellamore where the Campbell Creek Coal finally goes under drainage on the northern dip of the measures, and where the unquestioned Quakertown Coal has been prospected in the hills and from whence it has been traced to the Rowlesburg region. In the section for Gale, Upshur County, published in the Report last named above, page 141, both coals have been opened in the same hillside, separated by a concealed and sandstone interval of 22 feet. From Gale southward both coals were found and their relationship published in the sections for Pumpkintown, (pages 167-168), Cassity (pages 170-171), and Cassity Fork (page 172), the interval between the two diverging rapidly to the southwestward. Besides the three sections named above various others were

published showing clearly the base of the great Upper Connoquenessing Sandstone, below which the Quakertown Coal belongs by an interval that is usually less than 10 feet, and showing the Campbell Creek at its proper place in the measures much farther down. Besides the points named above the two coals were found in the same hillside at various other localities in this region, the several openings having been described under their proper horizons in the Report named. In the face of all these physical facts the writer can not yield to an assumption that is clearly hasty and based mainly on opinion.

The Lower Winifrede Coal of Krebs[21] was not observed in Webster, and being strictly a southern development, has probably disappeared from the measures in this county.

LOWER WINIFREDE SANDSTONE.

The Lower Winifrede Sandstone of White[22], coming a few feet under the Winifrede Coal, seems to be present in Webster, though not conspicuous, being gray and massive. It is noted in the section for Missouri Creek, published in Chapter IV.

The Chilton "A" Coal of Hennen and the writer[23], named from its occurrence in Logan and Mingo Counties, and belonging a short distance above the Chilton Coal. was not observed in Webster, having apparently disappeared in the northeastward thinning of the measures.

WINIFREDE LIMESTONE.

The Winifrede Limestone of White[24], named for its occurrence at Winifrede, Kanawha County, where it is found 65 to 70 feet below the Winifrede Coal, and where it contains an abundant marine fauna, was observed at a few points in Webster, being poorly represented and apparently lenticular in its nature, usually occurring in the form of black shale with

[21]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, p. 339; 1916.

[22]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 271; 1908.

[23]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 146-147; 1914.

[24]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 431; 1908.

limestone nodules. In Chapter IV it is noted in the section for Pugh, where it is 5 feet thick, coming 90 feet below the Stockton Coal, and being represented by black slate containing obscure remains possibly of fossil shells. In the same chapter it is recorded in the section for Palmer (Braxton County) where it contains a number of marine fossil forms as previously listed in the Braxton and Clay Report, page 263. In the section for Erbacon, published in Chapter IV, it is noted at an interval of 90 feet below the Stockton Coal, consisting of dark shale, with limestone boulders, no fossils having been observed. In the section for Boggs, published in the same chapter, it is recorded in the form of dark shale with ferriferous limestone nodules, 15 feet thick, one poorly preserved fossil, tentatively classed as a **Lingula**, having been observed, its interval below the Stockton Coal at this point being 135 feet. On Denison Run of Laurel Creek, 2.3 miles northeast of Cowen, it was observed in a ravine south of the stream, being in the form of black shale, 2 feet thick, at an eleation of 2465′ B., coming 60 feet below the Stockton Coal and containing **Naiadites** fossils.

The exact stratigraphic position of the Winifrede Limestone with reference to the Upper Chilton Sandstone is still a matter of some doubt, although Hennen, in a recent report[25], has tentatively placed it above that member, with the qualifying statement that it may possibly belong just below it, poor exposures of the various Chilton members east of the type locality of the Winifrede Limestone being responsible for the uncertainty. It is herein placed at the same horizon, subject to revision as future investigations may warrant.

UPPER CHILTON SANDSTONE.

The Upper Chilton Sandstone of White[26], named for its occurrence in the Great Kanawha Valley, where it belongs in the interval between the Lower Winifrede Sandstone and the Chilton Coal, is apparently present in Webster, being noted

[25]Ray V. Hennen, Fayette Report, W. Va. Geol. Survey, p. 243; 1919.

[26]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 271; 1908.

in Chapter IV in the sections for Tracy and Skyles, where it is a massive, gray ledge.

The Chilton "Rider" Coal of Hennen and the writer[27], named for its occurrence on Beech Creek and Dingess Run, Logan County, where it belongs a few feet above the Chilton Coal, was not observed in Webster, having apparently disappeared in the northeastward thinning of the measures.

CHILTON COAL.

The Chilton Coal of White[28], named for its occurrence near the village of Chilton, on Davis Creek, Kanawha County, was frequently observed in Webster, its interval below the Winifrede Coal being 40 to 50 feet and that below the top of the Homewood Sandstone, 280 to 310 feet. As a rule it is a bright, medium-soft, and single-bedded coal, varying from 1 to 4 feet in thickness, though usually it is not much more than 2 feet. Its character and areal extent, together with various detailed bed sections, will be presented in Chapter X under the subject of "Commercial Coal."

LOWER CHILTON SANDSTONE.

The Lower Chilton Sandstone of Hennen and the writer[29], named for its occurrence in Logan and Mingo Counties, is apparently represented in Webster, being noted in the section for Boggs, published in Chapter IV, where it has a thickness of 65 feet. As a rule it is massive and gray, its thickness being usually considerably less than that noted above.

The Little Chilton Coal of Hennen and the writer[30], belonging, at its type locality in Logan and Mingo Counties, a few feet below the Chilton Coal; the **Hernshaw Sandstone** of

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[27]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, p. 148; 1914.

[28]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 430; 1908.

[29]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 150-151; 1914.

[30]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 151-155; 1914.

Hennen and the writer[31], named for its relationship to the Hernshaw Coal; the **Hernshaw Coal** of Hennen and the writer[32], named for its occurrence at the town of Hernshaw, Kanawha County, where it has been commercially mined; the **Naugatuck Sandstone** of Hennen and the writer[33], named for its occurrence near the village of Naugatuck, Mingo County; the **Dingess Coal**, of Hennen and the writer[34], named from the village of Dingess, Mingo County, where it was once mined commercially; and the **Williamson Sandstone** of Hennen and the writer[35], named for its position between the Dingess and Williamson Coals, were not observed in Webster. It is possible that one or more of these members may eventually be found there but certainly not in good development and it seems likely that all of them have disappeared in the northeastward thinning of the measures.

DINGESS LIMESTONE.

The Dingess Limestone of Hennen and the writer[36], named for its occurrence near the village of Dingess, Mingo County, where it was discovered by the latter author, and being of wide-spread occurrence throughout the Guyandot and Great Kanawha Valleys, where its usual form is that of a siliceous or ferruginous shale, often containing limestone nodules, and frequently carrying marine fossils in profusion, was not observed in Webster. In view of the fact that it has recently been found by the writer in northern Nicholas, not many miles from the Webster line, with an abundant marine fauna, equal if not more abundant than that of its type locality, it seems probable that the same member with its fossils might extend northeastward into Webster and that by patient search it might be traced across this county.

The Williamson Coal of Hennen and the writer[37], named

[31]Ibid., pp. 155-156.
[32]Ibid., pp. 156-163.
[33]Ibid., pp. 163-164.
[34]Ibid., pp. 164-165 .
[35]Ibid., p. 165.
[36]Ibid., pp. 165-166.
[37]Ibid., pp. 166-168.

PLATE XI.—Lynch's Point, looking down Elk River, 3 miles west of Webster Springs; Topography of Pottsville in background and Mauch Chunk in foreground.

for its occurrence at the town of Williamson, Mingo County, where it has been mined commercially, was not observed in Webster, and may have disappeared from the measures, although its presence at one or two localities in northern Nicholas would indicate a possibility of its occurrence in Webster. In a recent Report[38], by Hennen, the Williamson Coal has been tentatively identified as occurring at a prospect on Holly River, near the village of Holly, Braxton County, but the writer believes that the Holly Coal represents the Cedar Grove, rather than the Williamson, for reasons that will be presented subsequently under discussion of the Cedar Grove, Campbell Creek and Eagle Coals.

UPPER CEDAR GROVE SANDSTONE.

The Upper Cedar Grove Sandstone of Hennen and the writer[39], named for its occurrence a few feet above the Cedar Grove Coal in Logan and Mingo Counties, is apparently represented in Webster, coming just over the coal above named and being a hard, massive, gray ledge, sometimes reaching 30 feet in thickness. In the section for Tracy, published in Chapter IV, it is 25 feet thick. On the Webster Springs-Cowen road, near the Pleasant Ridge School and at various other points northeast of Upper Glade, there is a massive cliff, about 30 feet in thickness, that apparently belongs at the horizon of the Upper Cedar Grove. So far as known it has not been quarried but its character in the latter locality would indicate that it would be well adapted for rough masonry structures where durability is the main factor.

The Seth Limestone of Krebs[40], named for its occurrence near the village of Seth, Boone County, belonging in the roof shales of the Cedar Grove Coal, and sometimes containing marine fossils, was not observed in Webster, having apparently disappeared in the northeastward thinning of the measures.

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[38]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 267-270; 1917.

[39]Hennen, and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 169-170; 1914.

[40]C. E. Krebs, Boone Report, W. Va. Geol. Survey, p. 155; 1915.

CEDAR GROVE COAL.

The Cedar Grove Coal of White[41], named for its occurrence at the village of that name in Kanawha County, where it has been mined commercially for many years, was observed at numerous points in northern Webster, being mined commercially at Summit Station on the West Virginia Midland Railroad. It varies in thickness from 1 to 4 feet, being usually medium-soft and single-bedded. Its stratigraphic position in the measures is 325 to 350 feet below the top of the Homewood Sandstone and 175 to 200 feet above the Eagle Coal. Its character and areal distribution, together with detailed bed sections, are discussed in Chapter X under the subject of "Commercial Coal," and on Map II its outcrop is delineated in those regions where it is known or believed to be of minable thickness.

MIDDLE CEDAR GROVE SANDSTONE.

The Middle Cedar Grove Sandstone of Hennen and the writer[42], named from its occurrence between the Cedar Grove and Lower Cedar Grove Coals, being found principally in some of the southwestern counties, is but poorly developed in Webster. In Chapter IV it is noted in the section for Summit, where it is only 4 feet thick. Elsewhere it was not noted.

LOWER CEDAR GROVE COAL.

The Lower Cedar Grove Coal of Hennen and the writer[43], named for its occurrence in Logan and Mingo Counties, where it comes a short distance below the Cedar Grove Coal, being separated from the latter seam by the Middle Cedar Grove Sandstone, does not appear to be well represented in Webster, having been noted at only a few points along the West Virginia Midland Railroad in the vicinity of the Holly-Elk divide, where it comes 10 to 15 feet below the Cedar Grove.

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[41]I. C. White, Bull. 65, U. S. Geol. Survey, pp. 138-140; 1891; and Vol. II, W. Va. Geol. Survey, p. 562; 1903.

[42]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 172-173; 1914.

[43]Hennen and Reger, Logan and Mingo Report, W. Va. Geol Survey, pp. 174-175; 1914.

At **Prospect No. 270 on Map II,** located on the waters of Grassy Creek, 0.8 mile north of Summit Station, it is 1′ 6″ thick, having an elevation of 1815′ B. Two other exposures show the following:

West Virginia Midland Railroad Exposure—No. 271 on Map II.

On Grassy Creek, 0.3 mile northeast of Summit Station; **Lower Cedar Grove Coal;** elevation, 1895′ B.

			Ft.	In.
Sandstone, massive			10	0
Coal, soft	0′	7″		
Coal, bony	0	3		
Coal, soft	0	8	1	6
Fire clay shale, to railroad grade			5	0

West Virginia Midland Railroad Exposure—No. 272 on Map II.

On Elk River, 0.6 mile southwest of Summit; **Lower Cedar Grove Coal;** elevation, 1920′ B.

			Ft.	In.
Coal, Cedar Grove, about			2	6
Fire clay shale			2	0
Sandstone, shaly			7	0
Slate, gray			2	0
Coal	1′	0″		
Slate, black	0	6	2	2
Coal	0	8		
Fire clay shale			4	0
Sandstone, shaly, to railroad grade			16	0

Lower Cedar Grove

Elsewhere in the county the Lower Cedar Grove Coal was not noted but it may be present in a few localities, there being no indications that it is of minable thickness at any point.

PEERLESS SANDSTONE.

The Peerless Sandstone of Krebs[44], named for its occurrence at the mouth of Campbell Creek, Kanawha County, where it belongs 30 to 40 feet above the Campbell Creek Coal (Peerless Bench), apparently extends northeastward into Webster, being a massive, gray ledge. In Chapter IV its character and thickness are recorded in the sections for Pugh,

[44]C. E. Krebs, Kanawha Report, W. Va. Geol. Survey, p. 281; 1914.

Big Run, Skelt, Boggs, and Skyles. So far as known it has not been quarried in the county, but its character is such that it could be used for rough masonry if so desired.

According to Hennen, in a recently published Report[45], the Peerless Sandstone has proved to be the same stratigraphic horizon as the **Lower Cedar Grove Sandstone** of Hennen and the writer[46], making it necessary to abandon the latter title as the Peerless was first named.

The Alma "A" Coal, of Hennen and the writer[47], named for its occurrence a few feet above the Alma Coal, was not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

The Alma Coal of White[48], named for its occurrence in Mingo County, and belonging a short distance below the Peerless Sandstone, is apparently represented in portions of the Holly River drainage in Webster, its position being 150 to 165 feet above the Eagle Coal and 375 to 400 feet below the top of the Homewood Sandstone. As a rule it is medium-soft and single-bedded, but sometimes contains a shale parting, its total thickness including the parting varying from 1 to 3 feet. Its areal extent, character and thickness, together with detailed bed sections, will be discussed in Chapter X under the subject of "Commercial Coal." Its outcrop is not shown on Map II as its position is only 30 to 40 feet above the Campbell Creek (Peerless Bench) Coal, the outcrop of which is shown, from which the Alma horizon may be located.

MONITOR SANDSTONE.

The Monitor Sandstone of Hennen[49], named from its occurrence at Monitor, Logan County, belonging a few feet below the Alma Coal, and being the same member as the **Logan**

[45]Ray V. Hennen, Fayette Report, W. Va. Geol. Survey, p. 251; 1919.

[46]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, p. 175; 1914.

[47]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 175-176; 1914.

[48]I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 404-407; 1908.

[49]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, p. 148; 1915.

Sandstone of Hennen and the writer[50], so called from its massive development in the vicinity of Logan, the title of "Logan" having been abandoned because of the fact that the same name has been previously used by the Ohio Geological Survey in designating an entirely different stratum, is apparently present at numerous points in Webster. It is a coarse, massive, gray stratum, sometimes 50 feet or more in thickness. In Chapter IV its thickness and character are recorded in the sections for Pugh, Skelt, Boggs, Skyles, and Redoak Knob. So far as known it has not been quarried, but its massive character and even grain would make it well adapted for structures where strong and durable masonry is desired.

The Little Alma Coal of Hennen and the writer[51], belonging at the base of the Monitor Sandstone, was not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

LOWER MONITOR SANDSTONE.

The Lower Monitor Sandstone of Hennen[52], coming next in descending order, seems to be present at a few localities in the county but is not conspicuous, its character, when present, being that of a massive, gray stratum.

CAMPBELL CREEK LIMESTONE.

The Campbell Creek Limestone of White[53], named from its occurrence a few feet above the Campbell Creek Coal in the region of the type locality of that seam in Kanawha County, and having the form of lens-shaped concretions bedded in shale, does not appear to be well represented in Webster. At the road fork just east of Upper Glade, however, a black shale was noted at an elevation of 2440′ B., with a scanty occur-

[50]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 178-180; 1914.

[51]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 180-183; 1914.

[52]Ray V. Hennen, Fayette Report, W. Va. Geol. Survey, p. 252; 1919.

[53]I. C. White, Bull. 65, U. S. Geol. Survey, p. 168; 1891; and Vol. II, W. Va. Geol. Survey, p. 566; 1903.

rence of fresh-water(?) fossils, that seems to be at this horizon. Elsewhere in the county it was not observed.

CAMPBELL CREEK (PEERLESS BENCH) COAL.

The Campbell Creek Coal of White[54], named for its occurrence on the creek of that name in Kanawha County, is a valuable and persistent member in the stratigraphy of Webster. As originally described by Dr. White its character on Campbell Creek is that of a soft, gas coal, of multiple-bedded type, which, when traced southeastward up the Great Kanawha River, splits into two separate and distinct seams, 20 to 30 feet apart, the upper bench being known as the **Peerless** and the lower as the **No. 2 Gas,** both of which have been mined commercially over wide areas in Kanawha, Fayette and other counties. In Webster both seams have been recognized, but the Peerless member is by far the more persistent and valuable.

The Peerless Coal, as it occurs in Webster, is usually single-bedded, soft, and gaseous, but in a limited portion of the Right Fork of Holly drainage area the whole seam becomes cannel Its thickness varies from 2 to 4 feet and on Laurel Creek of Elk it has been commercially mined in the vicinity of Arcola. Its position in the stratigraphic column varies from 100 to 135 feet above the Eagle Coal. Its areal extent, character, and quality, together with the description of numerous openings and prospects, will be discussed in Chapter X under the subject of "Commercial Coal," and on Map II its outcrop is delineated for those regions in which it is known or believed to be of minable character.

CAMPBELL CREEK (NO. 2 GAS BENCH) COAL.

The No. 2 Gas Bench of the **Campbell Creek Coal** of White[55], coming 20 to 30 feet below the Peerless Bench in certain portions of the Great Kanawha Valley, was noted at only a few points in Webster, its position being from 10 to

[54]I. C. White, Bull. 65, U. S. Geol. Survey, p. 170; 1891; and Vol. II, W. Va. Geol. Survey, pp. 567-584; 1903.

[55]Loc. cit.

20 feet below the Peerless and from 90 to 115 feet above the Eagle. At **Exposure No. 375 on Map II,** on a private road on the west side of Elk River, ½ mile west of Summit Station, Holly District, its blossom is exposed, being 2 feet thick, with an elevation of 1875′ B. In the section for Gulf Run, page 94, the coal is noted on the mountainside north of Elk River by Mr. Lemley, being recorded as 0′ 10″ thick. Just outside the county limits, it was observed on the eastern slope of the Cottle Knob, Beaver District, Nicholas County, 1.8 miles west of Allingdale, at an elevation of 2344′ B., 0′ 9″ being visible, at an interval of 14 feet below the Peerless Bench and 89 feet above the Eagle. These scanty and thin exposures of the No. 2 Gas Bench indicate that it is of little value for any purpose in Webster County.

The Lower Campbell Creek Sandstone of Krebs[56], named for its occurrence in Raleigh County, and the **Lower Campbell Creek Coal** of Krebs[57], named for its occurrence in the same county, were not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

BROWNSTOWN SANDSTONE.

The Brownstown Sandstone of White[58], named for its occurrence at Brownstown, Kanawha County, and there belonging almost immediately under the No. 2 Gas Coal, is a well-defined ledge in northwestern Webster, being 20 to 40 feet thick, hard, gray and massive. At the **West Virginia Midland Railroad Quarry,** located along the grade north of Elk River, 1 mile southwest of Summit Station, Holly District, this stone has been quarried for building purposes, the following section being measured at that point:

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[56]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, p. 327; 1916.

[57]Ibid., p. 328.

[58]I. C. White, Vol. II, W. Va. Geol. Survey, p. 586; 1903.

				Ft.	In.
Coal opening, abandoned, Campbell Creek (Peerless) Coal				----	----
Sandstone, massive, quarry rock, Brownstown				30	0
Shale, sandy and dark				6	0
Coal	0′	8″	Powellton "A" (1848′ B.)		
Fire clay shale	3	0	(Exposure No. 376 on Map II)	4	2
Coal, slaty	0	6			
Fire clay shale, with ferriferous limestone nodules, to railroad grade				10	0

The ledge has been quarried into the mountain a distance of 25 feet, the face of the workings being 75 feet long. The stone is hard, gray and massive, with irregular joint-planes.

In Glade District the Brownstown Sandstone is well exposed along Denison Run of Laurel Creek about two miles northeast of Cowen, being visible at numerous points along the public highway, and varying in thickness from 20 to 40 feet. It is visible again on Lost Run of Laurel Creek, 1.2 miles northeast of Weese, the elevation of its top being 1830′ B. In Chapter IV it is noted in the sections for Wheeler, Jumbo, Skelt, Tracy, Bernardstown, and Skyles. As a rule this stone is of a smooth, even-grained structure, and, as its position at various localities makes it easy of access, it should make a valuable quarry rock for general building purposes, where ornamental effects are not desired.

POWELLTON "A" COAL.

The Powellton "A" Coal of Hennen and the writer[59], named for its occurrence in Mingo County where it comes just below the Brownstown Sandstone and a few feet above the Powellton Coal, appears to be of only slight importance in Webster, having been observed in only a few localities. At Exposure No. 376 on Map II, on Elk River, 1 mile southwest of Summit Station, the section of which has been published on page 168, in connection with a quarry in the Brownstown Sandstone, it consists of two benches of coal only a few inches thick, separated by 3 feet of shale. On Point Mountain, Fork Lick District, what appears to be the same coal was noted at the following prospect:

[59]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, p. 192; 1914.

Wm. Wooddell Prospect—No. 377 on Map II.

On Point Mountain at the head of Potato Knob Run, 1.3 miles east of Woodzell; **Powellton "A" Coal**; elevation, 3170′ B.

			Ft.	In.
Shale, dark, sandy			2	0
Coal, cannelly	0′	4″		
Coal, soft	1	1		
Coal, bony	0	2		
Coal, soft	0	8	2	3
Slate, pavement			....	....

One-fourth mile farther south the following section of the coal was measured:

Coal Prospect—No. 378 on Map II.

On the head of Grandaddy Run of Elk River, 1.3 miles east of Woodzell; **Powellton "A" Coal**; elevation, 3180′ B.

			Ft.	In.
Sandstone, **Brownstown**			5	0
Slate, dark			1	0
Coal, cannelly	0′	5″		
Coal, medium-soft	1	2	1	7
Sandstone, massive			....	....

These few exposures of the Powellton "A" Coal above noted indicate that it has no commercial importance and furthermore will be of limited value as a local fuel producer.

POWELLTON (BROWNSTOWN) COAL.

The Powellton (Brownstown) Coal of White[59a], named for its occurrence at Powellton, Fayette County, and Brownstown (now Marmet), Kanawha County, having been mined extensively at these and other points in the Kanawha Valley, was observed at infrequent points in Webster, its stratigraphic position being a few feet below the Brownstown Sandstone, 70 to 90 feet below the Campbell Creek (Peerless Bench) Coal, and about 30 feet above the Eagle Coal. When found it was usually free from slate partings, the coal partly soft and gaseous, and partly of a harder variety.

In Hacker Valley District the coal was noted on Left

[59a] I. C. White, Vol. II, W. Va. Geol. Survey, pp. 511-512 and 585; and Vol. II(A), pp. 272 and 349; 1908.

Fork of Holly River at Wheeler, where, at **Exposure No. 379 on Map II,** it was 0′ 8″ thick, at an elevation of 1385′ B. Farther up the same valley the two following prospects were noted:

Henry Spies Heirs Prospect—No. 380 on Map II.

On Fall Run of Left Fork of Holly River, 0.7 mile southwest of Penbro; **Powellton Coal;** elevation, 2170′ B.

			Ft.	In.
Sandstone, massive			----	----
Coal, hard	0′	4″		
Coal, soft	2	0	2	4
Slate, pavement			----	----

Henry Spies Heirs Prospect—No. 381 on Map II.

On Fall Run of Left Fork of Holly River, 0.8 mile southwest of Penbro; **Powellton Coal;** elevation, 2215′ B.

	Ft.	In.
Sandstone, massive	----	----
Coal, soft	1	10
Fire clay shale, pavement	----	----

In **Holly District** the coal was once opened at the **W. B. Tracy Prospect (No. 382 on Map II),** located in a ravine on the steep mountain slope south of Elk River, 1.1 miles southwest of Tracy Switch, its elevation being 1975′ B., and its interval below the Stockton Coal 365 feet. The prospect had fallen shut and its thickness was not obtained, there being some coal and slate on the dump.

In **Glade District** the coal was observed at **Exposure No. 383 on Map II,** on a branch of Laurel Creek, 0.5 mile southwest of Jack, having a thickness of 1′ 0″, and an elevation of 1990′ B., and coming just beneath a massive exposure of the Brownstown Sandstone, 45 feet thick. At the **Felix Boggs Prospect (No. 384 on Map II),** located on Laurel Fork of Birch River, 0.9 mile northeast of Boggs, about 1 foot of coal was found, at an elevation of 1700′ B., coming 40 feet below the Campbell Creek (Peerless Bench) Coal. Another prospect farther up the same river shows the following:

Keystone Lumber and Mining Company Prospect—No. 385 on Map II.

On Johnson Branch of Birch River, 2.3 miles northwest of Cowen; **Powellton Coal**; elevation, 1915′ B.

			Ft.	In.
Shale, sandy			....	....
Coal, soft	0′	9″		
Coal, hard	1	9	2	6
Slate, pavement			....	....

A sample (No. 185R) was collected from Nos. 2 and 3 of section at this prospect, the composition of which is published under **Mine No. 385** in the Table of Coal Analyses at the end of Chapter X.

A short distance farther up Birch River the **Keystone Lumber and Mining Company Prospect (No. 386 on Map II)**, 2.3 miles northwest of Cowen showed 2′ 1″ of clean coal, at an elevation of 1931′ B.

The above prospects indicate that, while at a few scattered localities it may furnish local fuel, the Powellton seam can not be classed as a commercial coal, being much too thin for present mining over the main portion of the county where its horizon belongs. In the future when the thicker beds approach exhaustion, it will be practicable to mine this coal bed.

STOCKTON (CANNELTON) LIMESTONE.

The Stockton (Cannelton) Limestone of White[60], named for its occurrence at Cannelton, Kanawha County, where it was once manufactured into cement, being known as the "Stockton" cement bed, and there belonging 35 to 40 feet below the Powellton Coal, has almost entirely disappeared in Webster. In the section for Summit, page 88, a hard gray limestone, 0′ 6″ thick, is recorded, having an elevation of 1700′ B., and coming 12 feet above what appears to be the Eagle Coal horizon, that apparently correlates with the Stockton. In the section for Wainville, page 110, a siliceous limestone, 0′ 6″ thick, is noted, at an elevation of 1636′ B., coming 39 feet

[60]I. C. White, Vol. II, W. Va. Geol. Survey, pp. 511 and 586; 1903.

above the Eagle Coal, and apparently representing the same stratum as that found at Summit. Elsewhere in the county it was not observed.

The Matewan Coal of Hennen and the writer[61], named for its occurrence in Mingo County, and coming next in succession below the Stockton Limestone; the **Matewan Sandstone** of the same authors[62], named from the same locality and coming next below the Matewan Coal; and the **Eagle "A" Coal** of the same authors[63], being the next member below the Matewan Sandstone, were not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

EAGLE SANDSTONE.

The Eagle Sandstone of Hennen and the writer[64], named from the vicinity of Man, Logan County, and coming a few feet above the Eagle Coal, is a well-defined horizon in Webster. It is a gray, massive ledge of medium grain and medium hardness, tending at times toward a shaly nature and sometimes being almost entirely replaced by the Newlon Shale which belongs below it. Its thickness is variable, being in some localities less than 10 feet and at other points assuming the proportions of a great cliff, 60 to 70 feet thick. On Left Fork of Holly River at Poling it is a great cliff, 75 feet thick, with many wind-worn depressions on its face, the ledge coming just above the Eagle Coal which is visible at the highway grade at an elevation of 1220′ B. In Chapter IV its thickness and character are noted and described in the sections for Silica, Wheeler, Pugh, McCourt Ford, Houston Run, Turkey Mountain, and Wainville. No quarries were observed in this member and its tendency to become shaly would make it of less value for building purposes than many other more resistant ledges lying above and below it.

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[61]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, p. 197; 1914.

[62]Ibid., p. 199.

[63]Ibid., p. 200.

[64]Ibid., pp. 62 and 202.

NEWLON LIMESTONE AND SHALE.

The Newlon Limestone and Shale of the writer[65], named for its occurrence at Newlon, Upshur County, where it is a black fissile shale, containing large limestone concretions of the well-known "turtleback" type, and coming just above the horizon of the Eagle Coal, extends through Webster in good development. In the Holly River region this shale is generally prevalent above the Eagle Coal, being 5 to 10 feet thick as a rule, and sometimes almost replacing the Eagle Sandstone, its thickness increasing to 30 feet or more. Limestone concretions of large size were not noted, but sometimes small ferriferous lenses may be seen. In Chapter X its presence is noted in many of the detailed descriptions of openings in the Eagle Coal.

EAGLE COAL.

The Eagle Coal of White[66], named from its occurrence at Eagle Station, Fayette County, where it was first mined and named under this title by Mr. Weyant, and was also given the local trade name of "No. 1 Gas" because of its soft, coking character, is a bed of wide distribution and almost general occurrence in northwestern Webster where its horizon is found. It varies from 2 to 4 feet in thickness and usually has a soft, gaseous character, with occasional streaks of harder coal, and is featured by a slate or bony parting, several inches thick, coming about one foot from the top, that makes it easy of recognition but detracts considerably from its minable value. It has been used as the key-rock for the green structure contours shown for northwestern Webster on Map II, and its outcrop is shown on the same sheet. In Chapter X its character, areal extent, and tonnage will be discussed, together with the detailed description of many openings.

The **Bens Creek Sandstone** of Hennen and the writer[67],

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[65]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, pp. 281-282; 1918.

[66]I. C. White, Bull. 65, U. S. Geol. Survey, p. 140; 1891; and Vol. II, W. Va. Geol. Survey, p. 587; 1903.

[67]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 204-205; 1914.

and the **Bens Creek Coal** of the same authors[68], named from their occurrence in southern Mingo County, were not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

DECOTA SANDSTONE.

The Decota Sandstone of Krebs[69], named from its occurrence along Cabin Creek, Kanawha County, where it belongs in the interval separating the Eagle and Little Eagle Coals, is a well-developed stratum in northwestern Webster. It is a hard, gray, massive ledge, 10 to 40 feet in thickness, often making cliffs. On Birch River above the village of Boggs it may be seen at numerous points along the highway which closely follows the river, and below Boggs it forms the bed of the stream at various points. At McCoy's Mill, 1 mile southwest of Boggs, it forms two cataracts in the river, the upper having a height of 15 feet and the lower 20 feet, the thickness of the sandstone ledge being 35 feet. In Chapter IV its thickness and character are noted in the sections for Laurel Fork of Holly, McCourt Ford, Webster Springs (South), Bolair, and Skyles. So far as known it has not been quarried but its massive and durable character, and its accessibility along several of the streams and highways, make it readily available for masonry purposes. Its position may be easily determined from the Eagle Coal which lies only a few feet above it and the outcrop of which is delineated on Map II.

LITTLE EAGLE COAL.

The Little Eagle Coal of White[70], named for its occurrence at Eagle Station, Fayette County, where it belongs 20 to 30 feet below the Eagle Coal and 75 to 80 feet above the fossiliferous Eagle Limestone and Shale, is a fairly persistent stratum in Webster, being found 20 to 50 feet below the Eagle Coal. It is seldom more than 1 foot thick anywhere in the

[68]Ibid., pp. 205-206.

[69]C. E. Krebs, Kanawha Report, W. Va. Geol. Survey, p. 292; 1914.

[70]I. C. White, Bull. 65, U. S. Geol. Survey, p. 177; 1891; and Vol. II, W. Va. Geol. Survey, pp. 592-593; 1903.

county and is of little importance beyond its stratigraphic value.

In **Hacker Valley District** it was noted at **Prospect No. 509 on Map II,** on Hodam Creek, 1.1 miles southwest of Hacker Valley, where at the side of the public road it shows 1 foot of soft coal, at an elevation of 1500′ B. The following exposure was noted farther east at a low cataract in Holly River:

Coal Exposure—No. 510 on Map II.

On Left Fork of Holly River, just south of Potato Knob and 3.3 miles southeast of Hacker Valley; **Little Eagle Coal**; elevation, 1760′ B.

	Ft.	In.
Sandstone, massive, **Decota**	8	0
Coal, Little Eagle (1760′ B.)	1	0
Shale, dark, to base of falls	5	0
Sandstone, massive, visible in rapids	10	0

In **Holly District** it was noted at the **Albert Riffle Prospect (No. 511 on Map II),** on Lower Big Run of Holly, 1 mile northeast of Big Run Station, having a thickness of 1′ 5″, and an elevation of 1395′ B., and being only 5 feet below the Eagle Coal, the intervening sandstone and shales having thinned almost entirely away. At **Prospect No. 512 on Map II,** located on Desert Fork of Right Fork of Holly, 1.4 miles northeast of Jumbo, it was once opened, but measured only 0′ 6″ of coal, at an elevation of 1810′ B., coming just below 15 feet of Decota Sandstone. In Chapter IV it is noted by Lemley in the section for Gulf Run, along the mountainside north of Elk River, being 0′ 10″ thick.

In **Fork Lick District,** what appears to be the Little Eagle was noted at the **Adam Baughman Prospect (No. 513 on Map II),** located on the Gauley divide, 2.5 miles south of Bergoo village, its elevation being 3405′ B., and its thickness being reported 1′ 3″ by Mr. Baughman.

In **Glade District** it was noted at **Prospect No. 514 on Map II,** located on Laurel Creek of Elk, 1.2 miles south of Erbacon, having a thickness of 1′ 6″ and an elevation of 1565′ B., and coming 20 feet below the Eagle Coal. At **the Baltimore and Ohio Railroad Exposure (No. 515 on Map II),** located

on the same stream, opposite the village of Jack, the coal is visible in a cut, having a thickness of 0′ 6″, and an elevation of 1939′ B., and coming 16 feet below the Eagle. At **Coal Exposure No. 516 on Map II,** located on Laurel Fork of Birch River, 1 mile northeast of Boggs, the coal is visible along the highway, its thickness being 0′ 8″ and elevation 1610′ B., as recorded in the section for Boggs, page 111.

CEDAR COAL.

The Cedar Coal of Hennen and the writer[71], named from its occurrence in southern Mingo County, and lying a few feet below the Little Eagle Coal, appears to be of little importance in Webster. At **Prospect No. 517 on Map II,** located on a branch of Desert Fork of Right Fork of Holly, 0.6 mile northeast of Jumbo, Holly District, 1′ 0″ of clean coal was observed at an elevation of 1778′ L., coming 126 feet below the Eagle Coal and just above the Eagle Shale, that seems to represent the Cedar horizon. Along the same stream the same stratum has been prospected and gives the following section:

John T. McGraw Prospect—No. 518 on Map II.

On Desert Fork of Right Fork of Holly River, 0.8 mile northeast of Jumbo; **Cedar Coal**; elevation, 1790′ B.

			Ft.	In.
Sandstone, shaly			10	0
Coal, soft	2′	2″		
Bone	0	2	2	4
Slate, pavement			....	....

Elsewhere in the county the Cedar Coal was not observed and it must therefore be classed as too thin and lenticular to be regarded as an economic asset of the county.

GRAPEVINE SANDSTONE.

The Grapevine Sandstone of Hennen and the writer[72], named from its occurrence in southern Mingo County, and belonging just below the Cedar Coal, seldom appears in the stratigraphic column of Webster. On the Gauley-Williams

[71]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, p. 210; 1914.

[72]Ibid., p. 211.

PLATE XII.—Typical exposure of a Pottsville Sandstone along West Virginia Midland Railroad.

divide, 1.2 to 1.5 miles northwest of Dyer, a massive sandstone crops at several points along the ridge trail that seems to represent this member. In Chapter IV it has been recorded in the sections for Diana and Dogway, and doubtfully correlated, being massive, hard, and gray in character.

EAGLE LIMESTONE AND SHALE.

The Eagle Limestone and Shale of White[73], named for their occurrence at Eagle, Fayette County, where they are composed of limestone and shale coming 90 to 100 feet below the Eagle Coal and 75 to 80 feet below the Little Eagle, and where they contain marine fossils in profusion, are represented by nothing more than a decadent phase in Webster, since the limestone has disappeared almost completely, and the shale, while often observed, appears to be only sparingly fossiliferous at widely separated points. As a rule it is dark, argillaceous and fissile, 10 to 20 feet thick, coming 90 to 110 feet below the Eagle Coal.

In **Hacker Valley District,** a limestone that may be the Eagle, 0′ 4″ thick and siliceous, was observed on Fall Run of Left Fork of Holly River, 0.9 mile southeast of Penbro, coming 45 feet below the Eagle Coal, and having an elevation of 2325 feet, though its interval from the coal seems too small. In the same district on Hodam Creek the shale was observed in the public road, 0.7 mile south of Hodam village, having an elevation of 1825′ B., and being 4 feet thick, black, and containing **Naiadites.**

In **Holly District** a dark shale was noted in the public road one-half mile northeast of Jumbo on Right Fork of Holly, being 38 feet thick, dark and sandy, and containing what appeared to be fragments of fossil shells, its elevation being 1740′ L., and its distance below the Eagle Coal 164 feet, as recorded in the section for Jumbo, page 83. On the same branch of Holly it was observed in the steep mountainside just north of Diana, being a dark shale, 15 feet thick, and containing shell fragments, its interval below the Eagle Coal horizon being 145 feet, as exhibited in the section for Diana, page

[73]I. C. White, Bull. 65, U. S. Geol. Survey; pp. 140 and 177; 1891; and Vol. II, W. Va. Geol. Survey, p. 593; 1903.

81. On Oldlick Creek, Holly District, Braxton County, 0.3 mile southeast of Marpleton, there is visible 12 feet of black, fissile shale, at an elevation of 1015′ B., in which Ray V. Hennen reports **Lingula fossils,** that would correspond to the Eagle, this being the point where the horizon goes under drainage on the northwestward dip of the measures. Along the West Virginia Midland Railroad grade, the Eagle Shale was observed on Elk River, one-fourth mile northwest of Tracy Switch, its character being that of a dark, fissile shale, its thickness 20 feet, and its elevation 1755′ B. Here it contains **Naiadites,** and below it a streak of coal appears that is evidently the Little Cedar.

In **Glade District** near the Nicholas County Line, the shale was observed by Hennen and the writer along the road between Camden-on-Gauley and Strouds, 1 mile northwest of the former place, its elevation being 2155′ B., and its nature that of a dark shale. Numerous marine fossils, of types common in the Great Kanawha Valley, were found, indicating a much more vigorous phase of former life than was found anywhere else in the county. On the Cowen road, about one mile northeast of Camden-on-Gauley the same shale was observed at an elevation of 2255′ B., but no fossils were found.

LITTLE CEDAR COAL.

The Little Cedar Coal of Hennen and the writer[74], named for its occurrence at Cedar, Mingo County, where it comes just below the Eagle Limestone and Shale, has almost entirely disappeared in Webster, only a little black, coaly slate being noted at its horizon at one point along the Cowen road, one mile northeast of Camden-on-Gauley. Elsewhere in the county it was not observed.

LOWER WAR EAGLE SANDSTONE.

The Lower War Eagle Sandstone of Hennen and the writer[75], named for its occurrence in southeastern Mingo

[74]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, p. 215; 1914.

[75]Ibid., p. 216.

County, where it comes between the Little Cedar and the Lower War Eagle Coals, appears to have almost entirely disappeared in Webster. In Chapter IV it is noted in the section for Camden-on-Gauley, being 10 feet thick, and in that for Turkey Mountain, where a ledge 55 feet thick was questionably ascribed to this horizon. Elsewhere in the county it was not noted.

LOWER WAR EAGLE COAL.

The Lower War Eagle Coal of White[76], named from its occurrence in southeastern Mingo County, where it comes only a few feet below the Lower War Eagle Sandstone, and about 250 feet below what is now known to be the Eagle Coal, was identified at various points in Webster. In this county it is a soft, gaseous coal, often containing a considerable portion of slate that makes it unfit for mining, but over a limited area of the Holly River drainage it becomes a pure seam of two feet or more in thickness. Its interval below the Eagle Coal varies from 100 to 165 feet. Its areal extent, character, and thickness, together with detailed bed sections, will be presented in Chapter X, under the subject of "Commercial Coal." Its outcrop is not shown on Map II, but its position at any point may be closely approximated from its relationship to the Eagle Coal above and the Gilbert below, both of which are cropped on the map.

The Upper Gilbert Sandstone of Hennen and the writer[77], named for its occurrence near the town of Gilbert, Mingo County; the **Oceana Limestone** of Hennen[78], named for its exposure at Oceana, Wyoming County, and the **Glenalum Tunnel Coal** of Hennen and the writer[79], named from its occurrence in southeastern Mingo County, were not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

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[76]I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 318 and 325; 1908.

[77]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 217-218; 1914.

[78]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, pp. 164-165; 1915.

[79]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 218-219 and 707-715; 1914.

LOWER GILBERT SANDSTONE.

The Lower Gilbert Sandstone of Hennen and the writer[80], named for its exposure on the Guyandot River at Gilbert, Mingo County, where it is a massive cliff rock, preserves this character across several counties northeast of its type locality and in Webster still remains one of the most conspicuous ledges in the entire Kanawha Group. As exposed therein it is a massive, coarse-grained, gray stratum, very hard and resistant to erosion, often making great cliffs, and varying in thickness from 30 to 80 feet, its top coming at an interval of 110 to 170 feet below the Eagle Coal. In Chapter IV its thickness and character are recorded in the sections for Diana, Tracy, Little Grassy Creek, Webster Springs (North), Webster Springs (South), Bernardstown, Bergoo, Bolair, Turkey Mountain, Three Forks of Gauley, Boggs, Camden-on-Gauley, Dyer, and Cranberry, these various sections demonstrating the general occurrence of the stratum at practically every locality of the county where its horizon is above drainage.

In **Hacker Valley District** the ledge is prominent along Desert Fork of Left Fork of Holly River, about one mile northeast of Jumbo, there being several exposures. In **Holly District** it makes a great cliff, 105 feet thick, just north of the village of Diana, where it is just above drainage, and is also well exposed at the West Virginia Midland Railroad bridge across Right Fork of Holly River at the same town, as well as making numerous cliffs farther up the same river. On Houston Run of Elk, 1½ miles southeast of Centralia, it is exposed at several points along the stream which has been unable to cut through its hard mass, and it is prominent at various points along the Elk Valley between Centralia and Tracy. In **Fork Lick District** its position is well up against the steep mountainsides of the Elk and Gauley Rivers, but was usually noted when sections were measured to the level of its outcrop. In **Glade District** it is a prominent ledge, being mainly responsible for the flat lands at the head of Price

[80]Ibid., p. 219.

Glade Run and Big Ditch Run on both of which its outcrop, with a dip to the northwest counter to the direction of the drainage, makes a natural dam to hold the sediments. In the vicinity of Camden-on-Gauley and Allingdale, it is a prominent stratum, forming cliffs at numerous points just above the Gilbert Coal (the outcrop of which is shown on Map II). On the Cranberry Ridge, about two miles southeast of Gauley Mills, it is exposed at several points along the highway, and farther southeast along the road leading from Big Laurel Creek to the Bishop Knob, and thence northward toward Dyer this ledge makes the flat top of the mountain for several miles, being covered by only a thin deposit of soil. On the high ridge between Gauley and Williams Rivers, 2 to 3 miles northeast of Dyer, it forms the top of the mountain, being very coarse and massive.

No quarries were observed on the Lower Gilbert Sandstone, but its massive and durable character, together with its convenient location along the highways at numerous points, would make it an ideal quarry rock for massive masonry structures and general building purposes.

The **Gilbert "A" Coal** of Hennen[81], named from its occurrence in McDowell County, where it comes just under the Lower Gilbert Sandstone, was not observed in Webster, having evidently thinned away somewhere southwest of the county border.

GILBERT SHALE.

The Gilbert Shale of Hennen[82], named from western Wyoming County, where it comes just under the Lower Gilbert Sandstone and contains fossils largely of marine character, was observed at infrequent points in Webster, coming between the sandstone above noted and the Gilbert Coal, and varying from 0 to 6 feet in thickness. No fossils were observed at this horizon. Various exposures of this shale are noted in the detailed sections of the Gilbert Coal in Chapter X.

[81]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, p. 167; 1915.

[82]Ibid., p. 168.

GILBERT COAL.

The Gilbert Coal of Hennen and the writer[83], named for its occurrence on the Guyandot River at the town of Gilbert, Mingo County, where it belongs only a few feet under the Lower Gilbert Sandstone, was observed at various points in Webster. As a rule it is soft and columnar in character, without slate partings, varying in thickness from 1 to 4 feet, and coming 150 to 250 feet below the Eagle Coal. Its areal extent, character, and quality, together with the description of numerous openings and prospects and an estimate of its available tonnage, will be discussed in Chapter X under the subject of "Commercial Coal", and on Map II its outcrop is delineated for those regions where it is known or believed to be of minable thickness.

DOTSON SANDSTONE.

The Dotson Sandstone of Campbell[84], named from its occurrence at Wyoming Station (formerly Dotson), Mingo County, is present in Webster, having been noted at various points in those regions where its horizon is above drainage. As a rule it is a hard, massive, coarse, gray stratum, frequently making cliffs, its thickness being 20 to 65 feet, and its position in the measures being 5 to 20 feet below the Gilbert Coal. It appears to be best developed on the waters of Gauley, Williams, and Cranberry Rivers. At Camden-on-Gauley it is a prominent stratum along the north side of the river, being only 20 to 40 feet above drainage and having a thickness of 20 to 60 feet, and being prominent at various points along the highway westward to the county line at Allingdale, where it may be seen coming almost directly under the Gilbert Coal. Farther up Gauley at the mouth of Big Ditch Run it is one of a series of great ledges just north of the railroad, its thickness being 60 feet and its elevation 2255′ B. Farther up the same tributary it is visible at various points south of Cowen. In Chapter IV it is recorded in the sections for Turkey Moun-

[83]Hennen and Reger, Logan and Mingo Report, W. Va. Geol. Survey, pp. 221-222; 1914.

[84]M. R. Campbell, Tazewell Folio, No. 44, U. S. Geol. Survey; 1898.

tain, Three Forks of Gauley, Camden-on-Gauley, Dyer, Cranberry, and Snakeden Mountain. No quarries were observed on this ledge but its massive and durable character would make it a good stone for heavy masonry structures.

DOUGLAS "A" COAL.

The Douglas "A" Coal of Hennen[85], named from its occurrence in southern McDowell County, where it comes just beneath the Dotson Sandstone, was seldom noted in Webster. On the south side of Elk River, one mile northwest of Tracy Switch, what appears to be this coal has been opened by George Thorpe at the **Enoch Morgan Prospect (No. 545 on Map II)**, having a thickness of 2′ 10″ of coal, an elevation of 1610′ B., and coming 8 feet above the Douglas Coal. If the identification at this point is correct it appears to be only a local thickening of the seam since it was not observed in perceptible thickness elsewhere in the county. It is very certain that there is not sufficient Douglas "A" Coal in the county to be classed as an economic deposit.

DOUGLAS COAL.

The Douglas Coal of Hennen[86], named from its occurrence at the town of Douglas, McDowell County, where it comes 15 to 30 feet below the Dotson Sandstone, has little value in Webster, having been noted at only a few localities. In this county it belongs only a few feet below the Dotson Sandstone, and from 50 to 100 feet below the Gilbert Coal, depending on the locality. The following opening, made by George Thorpe, in Holly District, is the only one noted in the county:

Enoch Morgan Prospect—No. 546 on Map II.

On the south side of Elk River, 1 mile northwest of Tracy Switch; **Douglas Coal**; elevation 1610′ B.

[85]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, p. 181; 1915.

[86]Ibid., pp. 181-182.

			Ft.	In.
Shale, dark, sandy, from level of Douglas "A" Coal			7	0
Coal, medium-soft	1′ 10″	Douglas	2	2
Bone	0 4			
Slate, pavement			....	....

In Glade District the record of the **J. N. Camden No. 1 (20) Well,** located at Camden-on-Gauley, and published in connection with the section for that point, page 115, shows a coal at 35 feet that apparently correlates with the Douglas, its thickness being recorded as 3 feet. In the section for Dyer, page 117, the blossom of the Douglas Coal is recorded at 2675′ B., coming 25 feet below the Dotson Sandstone.

The few and scattered localities where the Douglas Coal has been noted indicate that it can not be classed as an economic deposit of value in the county.

LOWER DOTSON SANDSTONE.

The Lower Dotson Sandstone of Hennen[87], named from its relationship to the Dotson Sandstone of Mingo County, and coming 0 to 5 feet below the Douglas Coal, occurs in Webster, having been noted at various points in the southern portion of the county, and occurring at 10 to 50 feet below the Dotson Sandstone. It is coarse, gray, hard, and massive, sometimes forming cliffs. In Chapter IV its thickness and character are recorded in the sections for Webster Springs (South), Bolair, Turkey Mountain, Camden-on-Gauley, Dyer, Three Forks of Williams, Cranberry, Camp 4 on Cranberry, and Snakeden Mountain. So far as known it has not been quarried in the county but its hard and durable nature would make it suitable for massive masonry structures.

DOUGLAS SHALE.

The Douglas Shale of Hennen[88], named from its occurrence near the town of Douglas, McDowell County, where it comes just below the Lower Dotson Sandstone, and occa-

[87]Ray V. Hennen, Fayette Report, W. Va. Geol. Survey, pp. 274-275; 1919.

[88]Ray V. Hennen, Wyoming-McDowell Report, W. Va. Geol. Survey, pp. 183-184; 1915.

sionally bearing marine fossils, appears to be prevalent in various portions of Webster, having been noted in scattered localities. In the section for Camden-on-Gauley, page 115, it is recorded in the oil well boring at that place, coming just under the Lower Dotson Sandstone, and having a thickness of 8 feet. Certain other exposures are recorded in subsequent pages under the description of the Lower Douglas Coal, over which it lies. As a rule it is a dark-gray, or black, shale, but no fossils were noted.

LOWER DOUGLAS COAL.

The Lower Douglas Coal of Hennen[89], named from its occurrence at the town of Douglas, McDowell County, where it comes just above the Panther Sandstone, now believed to be the same as the Upper Nuttall, was noted at various points in southern Webster. As a rule it is thin and slaty, its interval below the Gilbert Coal varying from 75 to 125 feet.

In **Holly District** the following prospect was observed, having been opened by George Thorpe:

Enoch Morgan Prospect—No. 547 on Map II.

On the south side of Elk River, 0.9 mile northwest of Tracy Switch; **Lower Douglas Coal**; elevation, 1585′ B.

	Ft.	In.
Concealed and shale, dark, sandy, **Douglas**, from level of Douglas Coal	12	0
Coal, medium-soft, Lower Douglas	3	0
Slate, pavement	----	----

In **Fork Lick District** it was noted at the **W. G. Payne Prospect (No. 548 on Map II)**, located on the south side of Elk River, 1.2 miles south of Webster Springs, where, as recorded in the section for Webster Springs (South), page 97, it is from 1 to 2 feet thick, coming just under the Lower Dotson Sandstone, its elevation being 2825′ B. The following opening well represents its typical slaty character:

[89]Ibid., pp. 184-185.

Thomas Hamrick Prospect—No. 549 on Map II.

On a branch of Mill Run of Elk, 2.1 miles west of Bergoo; **Lower Douglas Coal**; elevation, 3035′ B.

			Ft.	In.
Coal blossom, thickness concealed			....	....
Shale, gray	0′	6″		
Coal, slaty	0	11		
Shale, gray	0	7		
Coal, slaty	0	9	2	9
Slate and concealed			5	0
Sandstone, massive, cliff rock, **Upper Nuttall**			....	....

On Point Mountain what appears to be the same coal has been opened at the **A. H. McAtee Exposure (No. 550 on Map II)**, 0.5 mile east of Waneta, where the coal has been partially laid bare at Mr. McAtee's spring near his residence. Only 0′ 8″ of coal was visible, the remainder being covered by water, its elevation being 3250′ B.

On Gauley River the following exposure along a public road seems to represent the Lower Douglas:

Coal Exposure—No. 551 on Map II.

On a short branch of Gauley River, 0.8 mile northwest of Bolair; **Lower Douglas Coal**; elevation, 2640′ B.

	Ft.	In.
Coal, Lower Douglas	1	6
Fire clay shale	1	0
Sandstone, massive, **Upper Nuttall**	....	....

Farther east on the divide between Gauley and Elk, the coal was noted again at the **Currence Cogar Prospect (No. 552 on Map II)**, 1.2 miles northwest of the mouth of Hughes Run, its thickness being 1′ 5″ and its elevation 3060′ B.

In the section for Camden-on-Gauley, page 115, the coal is noted at a depth of 60 feet in the record of the **J. N. Camden No. 1 (20) Well** at that place, its thickness being 1 foot, and its position in the measures only 5 feet above the top of the Upper Nuttall Sandstone.

These various exposures do not indicate that the Lower Douglas Coal is of merchantable thickness and purity in any quantity in the county or that it will furnish local fuel to any important extent.

CHAPTER VII.

STRATIGRAPHY, NEW RIVER GROUP OF THE POTTSVILLE SERIES.

GENERAL ACCOUNT.

The New River Group of Fontaine[1] or **Middle Pottsville** of White[2], named from its magnificent development along New River in Fayette and Raleigh Counties, West Virginia, and first studied by Prof. Wm. M. Fontaine in 1874, and later described in much detail by Dr. I. C. White, composes approximately the lower third of the Pottsville sediments of Webster County. As it occurs therein it may be defined as starting with the top of the Upper Nuttall Sandstone and extending downward to and including the Pineville Sandstone, which lies just over the Mauch Chunk Red Beds, since the Pocahontas Group of the Pottsville, which in counties farther southeast intervenes between the New River Group and the Reds, is entirely absent in Webster. The New River Group is known to be present in the measures over the entire county, except along the Elk and certain other southern rivers where the streams have cut entirely through it making narrow strips of territory along their valleys where no Pottsville sediments now exist. North of Elk River where it lies under drainage principally, its thickness and character are known only through scanty bore hole records, in some of which there is an almost complete absence of New River Coals, making it hard to determine the division line between the Kanawha and New River, although some of the massive sandstones and black shales of the latter group, as well as thin beds of coal, most certainly exist. In southern and southwestern Webster,

[1]Prof. Wm. M. Fontaine, The Great Conglomerate on New River, West Virginia, Amer. Jour. Science, third series, Vol. VII, 1874, pp. 459-573. The Conglomerate Series of West Virginia; Amer. Jour. Science, third series, Vol. IX, 1876, pp. 276-374.

[2]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 13; 1908.

however, along both sides of Elk River, and south of the same stream, the New River Group thickens rapidly, its sandstones becoming more numerous and more massive, its shales becoming thicker, and its coals developing into commercial beds of good thickness and great intrinsic value. At Camden-on-Gauley, as shown by a well record (No. 20 on Map II), it has a thickness of 634 feet, and has several coal seams of minable character, this thickness being about two-thirds as great as the maximum of 1030 to 1050 feet noted for southern McDowell County.

In Webster the New River Group is composed of massive, gray sandstones, very hard and sometimes pebbly, alternating with layers of dark or sandy shales, some of which contain fossils of marine or brackish-water origin, and beds of soft, columnar coal, there being no limestones of any kind except occasional small concretions in some of the shales. Lithologically the group contains about 70 per cent. of sandstone, 25 per cent. of shale or impure fire clay, and 5 per cent. of coal.

The thickness, stratigraphic position and general character of the various members of the New River Group are presented in Chapter VI, pages 145 to 147, in the general section of the Pottsville Series. In Chapter IV are published many measured sections at different points of the county, showing detailed stratigraphic studies.

DESCRIPTION OF MEMBERS, NEW RIVER GROUP.

UPPER NUTTALL SANDSTONE.

The Nuttall Sandstone of Campbell and White[3], later termed the **Upper Nuttall Sandstone** by Hennen[4], for the sake of convenience, and named from its occurrence along New River, Fayette County, between Nuttallburg and Gauley Bridge, where it is a prominent ledge coming a few feet above

[3]M. R. Campbell, Raleigh Folio, U. S. Geol. Survey; 1901. I. C. White, Bull. 65, U. S. Geol. Survey, p. 200; 1891; Vol. II, W. Va. Geol. Survey, pp. 616 and 655; 1903; and Vol. II(A), W. Va. Geol. Survey, pp. 253-254; 1908.

[4]Ray V. Hennen, Fayette Report, W. Va. Geol. Survey, p. 295; 1919.

the massive Lower Nuttall ledge, and being the topmost member of the New River Group, is found at many points in southern Webster, although it lacks much of the cliff-making character that distinguishes it farther southwest. In Webster it is a massive, hard, gray formation, 30 to 80 feet thick, its top coming 300 to 400 feet above the Sewell Coal, and in the Gauley and Cranberry drainage basins sometimes carrying small quartz pebbles and frequently making cliffs.

Along Elk River the Upper Nuttall was observed on the mountainside north of the West Virginia Midland Railroad, 1.1 miles northwest of Skidmore Crossing, making a 30-foot cliff, at an elevation of 1900′ B., its base being 265 feet above the Sewell Coal which crops at railroad grade. Farther up Elk, above Webster Springs, the ledge is well up toward the top of the mountains, not being conspicuous along their wooded slopes. On a branch of Mill Run, 1.5 miles west of Bergoo, it was observed at an elevation of 3010′ B., quartz pebbles being noticeable. In the Gauley Valley it was observed on Laurel Creek, 3.2 miles east of Bolair, making a cliff 30 feet thick and carrying small quartz pebbles, its elevation being 2925′ B. At the head of the same tributary, 5 miles east of Bolair, it was observed along the trail, at an elevation of 2960′ B., quartz pebbles being noted. Farther east along the Gauley divide various exposures were observed, its position being well up toward the top of the mountain. At the mouth of Big Ditch Run, 3 miles northeast of Gauley Mills, it makes a cliff just northwest of the mouth of that stream, its thickness being 40 feet, and its elevation 2175′ B. On Williams River it was observed at the point where that stream flows into Gauley, 2.3 miles west of Dyer, making a cliff, 40 feet thick, very massive and coarse, its elevation being 2275′ B., and its height above drainage 80 feet. At this point it has been quarried recently for aggregate used in the construction of the concrete bridge which spans Williams River at its mouth. The same stratum makes a conspicuous cliff along the north side of Williams River for half a mile or more eastward toward Dyer, the Lower Nuttall appearing only a few feet below it. In the Cranberry River it is well up toward the top

of the mountains, its character being much the same as on Gauley and Williams. In Chapter IV its thickness and character are recorded in the sections for Arvondale Junction, Big Run, Skelt, Webster Springs (South), Bernardstown, Bergoo, Bolair, Three Forks of Gauley, Camden-on-Gauley, Three Forks of Williams, Cranberry, Snakeden Mountain, and Dogway.

As a quarry rock the Upper Nuttall Sandstone should prove suitable for nearly all purposes where massive masonry is desired, as it is generally massive and durable. Its position can easily be determined at any point where it is above drainage in the county by referring to Map II on which the junction line between the Kanawha and New River Groups is delineated, immediately below which this stratum occurs.

The Iaeger "B" Coal of Hennen[5], named from its occurrence in McDowell County, and belonging in the interval between the Upper and Lower Nuttall Sandstones, was not observed in Webster, having evidently disappeared in the northeastward thinning of the strata.

LOWER NUTTALL SANDSTONE.

The Lower Nuttall Sandstone of Hennen[6], named for its close relationship to the Upper Nuttall Sandstone in the New River gorge of Fayette County, and being separated from the same by an interval of only a few feet, is found generally throughout southern Webster in the region where its horizon outcrops, but is a much less prominent ledge than in the region of its type locality. In Fayette and Nicholas Counties it makes a line of almost unbroken cliffs 75 to 100 feet thick, for many miles along the gorges of New, Gauley, and Meadow Rivers, being usually a conglomerate with large quartz pebbles. In Webster County it varies in thickness from 50 to 90 feet, sometimes carries small quartz pebbles but frequently is merely a coarse-textured stone without quartzitic inclusions,

[5]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, pp. 186-187; 1915.

[6]Ray V. Hennen, Fayette Report, W. Va. Geol. Survey; p. 297; 1919.

and makes cliffs at only irregular intervals along the river valleys, being as a rule hard and gray.

On Elk River it was noted on the mountainside north of the West Virginia Midland Railroad, 1.1 miles northwest of Skidmore Crossing, making a coarse cliff, 55 feet thick, at an elevation of 1835′ B., coming only a few feet below the Upper Nuttall Sandstone and 200 feet above the Sewell Coal which crops at the railroad grade. On Back Fork of Elk River it was noted 0.5 mile east of Breece where it makes a cliff at an elevation of 2450′ B. Farther up the main Elk Valley above Webster Springs, its outcrop is well up toward the tops of the mountains and it was noted only at points where sections were measured. In the Gauley Valley its most western outcrop in Webster appears to be at the mouth of Big Ditch Run, 3 miles northeast of Gauley Mills, where 10 feet of its upper portion is exposed above drainage, its top having an elevation of 2105′ B. At the mouth of Price Run, 1.3 miles southwest of Bolair, it makes a heavy cliff on the north side of Gauley, 75 feet thick and pebbly, at an elevation of 2505′ B. On Williams River, 0.5 mile above its mouth, the ledge was observed at an elevation of 2195′ B., making a cliff 35 feet thick. At this point it has been quarried for aggregate in the concrete bridge which spans Williams River at its mouth, being hard, white, and pebbly. On Cranberry River it may be seen at various points, being visible on the north side of the valley just south of the Bishop Knob, where it makes a cliff 35 feet thick and pebbly, at an elevation of 2705′ B., and on the same side of the river at the mouth of Lick Branch, where it makes a pebbly cliff 40 feet thick. On Dogway Fork, 1 mile south of Dogway village, and near the common corner of Webster, Pocahontas, and Greenbrier Counties, it makes a pebbly cliff at an elevation of 3745′ B. In Chapter IV, it is noted in the sections for Arvondale Junction, Big Run, Jumbo, Skelt, Summit, McCourt Ford, Tracy, Webster Springs (South), Bergoo, Elk Mountain, Camden-on-Gauley, Dyer, Cranberry, Camp 4 on Cranberry, Snakeden Mountain, and Dogway.

The Iaeger "A" Coal of Hennen[7], named from its occurrence in McDowell County, where it comes only a few feet beneath what now appears to be the true Lower Nuttall Sandstone (having been erroneously correlated as the "Upper Iaeger" in that volume), was not noted in Webster, having evidently disappeared in the northeastward thinning of the measures.

UPPER IAEGER SHALE.

The Upper Iaeger Shale of Hennen[8], named from its occurrence in McDowell County where it comes between the "Upper Iaeger" (Lower Nuttall) Sandstone and the "Iaeger (Hughes Ferry) Coal, is present at various points in Webster, its thickness varying from 0 to 20 feet, being usually dark-gray in color and having no especial stratigraphic or economic importance. In Chapter IX its thickness and character are recorded in the description of various openings of the Hughes Ferry Coal, over which it lies.

HUGHES FERRY (IAEGER) COAL.

The Hughes Ferry Coal of White[9], named for its occurrence at the Hughes Ferry bridge across Gauley River in central Nicholas County, where it comes only a few feet below the great Lower Nuttall Sandstone cliff that extends along that river, and believed by Hennen[10] to represent the **Iaeger Coal** of White[11], was observed at numerous points in southern Webster where its horizon outcrops. As a rule it is a soft, columnar coal, usually single-bedded, varying in thickness from 1 to 4 feet, and coming only a few feet below the Lower Nuttall Sandstone, its interval above the Sewell Coal being 150 to 225 feet. A discussion of its character and areal extent, together with detailed bed sections and an estimate

[7]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, p. 188; 1915.

[8]Ibid., p. 188-189.

[9]I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 252-253; 1908.

[10]Ray V. Hennen, Fayette Report, W. Va. Geol. Survey, p. 299; 1919.

[11]I. C. White, Vol. II(A), W. Va., G. S., pp. 251-252; 1908.

PLATE XIII.—Elk River Valley looking southeast from Johns Point; Topography of Pottsville and Mauch Chunk Series.

of its available tonnage, will be presented in Chapter X, under the subject of "Commercial Coal", its outcrop being delineated on Map II for those localities in which it is known or believed to be of minable thickness.

MIDDLE IAEGER SANDSTONE.

The Middle Iaeger Sandstone of Hennen[12], named from its occurrence at Iaeger, McDowell County, where it comes between the Hughes Ferry (Iaeger) Coal and the Lower Iaeger Coal, was seldom observed in Webster, although it appears to be present in a few localities. In the section for Skelt, page 86, it is recorded as 15 feet thick and shaly, coming between the two coals named above. In the section for Bernardstown, page 99, it is noted as 35 feet thick and shaly, coming only a short distance below the Hughes Ferry Coal. As a quarry rock it would not prove useful.

LOWER IAEGER COAL.

The Lower Iaeger Coal of Hennen[13], named from its occurrence at Iaeger, McDowell County, where it comes just below the Middle Iaeger Sandstone, was observed at a few localities in Webster, but is entirely too thin and lenticular for successful mining. Such exposures as were noted show a soft, columnar coal, varying from a few inches to 1 foot in thickness, its stratigraphic position being 20 to 60 feet below the Hughes Ferry and 80 to 150 feet above the Sewell Coal. In the section for Skelt, page 86, it is noted as having been prospected for at an elevation of 2050′ B., coming 40 feet below the Hughes Ferry Coal, but showing nothing but a little slate and coal blossom on the dump.

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[12]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, p. 190; 1915.

[13]Ibid., p. 190.

A. H. Cummings Prospect—No. 568 on Map II.

On Baltimore Run of main Elk River, 1.2 miles northeast of Bernardstown; **Lower Iaeger Coal**; elevation, 2810′ B.

	Ft.	In.
Shale, dark, sandy	7	0
Coal, medium-hard	1	10
Bone	0	2
Shale, gray, pavement	....	....

At the **Cherry River Boom & Lumber Co. Prospect (No. 569 on Map II)**, located 0.6 mile southwest of the Three Forks of Williams River, Glade District, the coal measured 0′ 8″ thick, being slaty and having an elevation of 2795′ B. In the same district and on Rocklick Branch of the same river, 0.5 mile above its mouth, the **Cherry River Boom and Lumber Company Prospect (No. 570 on Map II)**, measured 1′ 1″ of coal, its elevation being 3255′ B. No other exposures were observed in the county.

The Lower Iaeger Sandstone of Hennen[14], named from its occurrence near Iaeger, McDowell County, where it comes in the interval between the Lower Iaeger Coal and the Harvey Sandstone, was not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

LOWER IAEGER SHALE.

The Lower Iaeger Shale of Hennen[15], named for its occurrence near Iaeger, McDowell County, where it comes just above the Harvey Sandstone, is present in a few localities in Webster, although it is not conspicuous and has no especial economic value or scientific interest. It is usually a dark, argillaceous, laminated deposit, being seldom more than 5 feet in thickness.

HARVEY CONGLOMERATE SANDSTONE.

The Harvey Conglomerate of Campbell[16] named from the town of Harvey (now Bolt P. O.), Raleigh County, where it comes 50 to 100 feet below the Lower Nuttall Sandstone, was

[14]Ibid., p. 191.

[15]Ibid., pp. 191-192.

[16]M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Survey; 1902.

noted in various localities of southern Webster County where its horizon is exposed. In Webster it is, as a rule, massive, coarse, gray, and hard, varying in thickness from 20 to 35 feet, and occasionally carrying small quartz pebbles, though it is usually smooth-grained, differing materially in this respect from its typical nature in Raleigh County. In Chapter IV it is recorded and described in the sections for Tracy, Bergoo, Three Forks of Gauley, Camden-on-Gauley, and Three Forks of Williams. So far as known it has not been quarried in the county but its massive and durable nature would make it well adapted for heavy masonry structures.

SANDY HUFF SHALE.

The Sandy Huff Shale of Hennen[17], named from its exposure at the mouth of Sandy Huff Branch, McDowell County, and belonging between the Harvey Conglomerate Sandstone and the Castle Coal, appears to be represented in the measures of Webster, although it is not conspicuous. As a rule it is dark, argillaceous and laminated, varying from 0 to 10 feet in thickness, and possessing no especial economic value or scientific interest. In the section for Camden-on-Gauley, published in Chapter IV, it is recorded as being 18 feet thick in the oil well drilled at that place. In subsequent pages its presence is noted under the description of various exposures of the Castle Coal over which it lies.

CASTLE COAL.

The Castle Coal of Hennen[18], named from its exposure at the town of Castle, Wyoming County, where it comes directly above the Guyandot Sandstone, and 150 to 175 feet above the Sewell Coal, is present in Webster but not in commercial thickness and purity. In this county, as a rule, it is a soft, columnar coal, varying from 1 to 2 feet in thickness and sometimes being slaty, its stratigraphic position being in the shale interval separating the Harvey Conglomerate from the Guyandot Sandstone.

[17]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, p. 193; 1915.
[18]Ibid., pp. 193-194.

In **Holly District** the following exposure was noted in a ravine:

Coal Prospect—No. 571 on Map II.

On Little Sugar Creek, 1.1 miles northeast of Skelt; **Castle Coal**; elevation, 2135′ B.

		Ft.	In.
Shale, dark, **Sandy Huff**		....	....
Coal	0′ 10″		
Bone	0 2	1	0
Sandstone, massive, **Guyandot**		....	....

In **Fork Lick District** the coal was once opened on the north side of Back Fork of Elk at the **E. H. Gillespie Prospect (No. 572 on Map II)**, 0.8 mile northeast of Webster Springs, at an elevation of 2345′ B., where it measured a total of 3′ 1″, of which 1′ 4″ was bony coal, coming at the middle of the seam, as exhibited in the section for Webster Springs (North), page 95, its position being 85 feet above the Sewell which also has been opened on the same mountain.

On Drybed Run of Back Fork, 2.2 miles northeast of Webster Springs, the coal was once opened at the **George Miller Prospect (No. 573 on Map II)**, being reported as only 0′ 6″ thick, its elevation being 2330′ B., a vertical distance of 120 feet above the Sewell.

At **Coal Exposure No. 574 on Map II**, located on the north side of Elk River, 0.5 mile northeast of Bernardstown, the coal is exposed in the Summersville and Slaven Cabin Pike, its elevation being 2575′ B., and its thickness 2 feet, as exhibited in the section for Bernardstown, page 99.

On Gauley River the coal was noted at the **Smoot Lumber Company Prospect (No. 575 on Map II)**, on the south side of the stream, 1.2 miles southwest of Bolair, where it has a thickness of 3′ 4″, but is slaty. On Williams Camp Run of the same river, 0.5 mile northeast of the mouth of this tributary and 4 miles due south of the village of Bergoo, the **Pardee & Curtin Lumber Company Prospect (No. 576 on Map II)**, showed 1 foot of clean, soft coal, at an elevation of 2865′ B., coming 100 feet above an opening in the Sewell.

In **Glade District** the coal was once opened at the **John Chipps Prospect (No. 577 on Map II)**, located on the north side of Williams River, 0.7 mile southwest of Dyer, at an elevation of 2285′ B., its thickness being reported at 1′ 3″, as noted in the section for Dyer, page 117. Farther up the same river the following opening was noted:

Cherry River Boom and Lumber Company Prospect—No. 578 on Map II.

On Lick Branch of Williams River, 0.8 mile west of the Three Forks of Williams; **Castle Coal**; elevation, 2735′ B.

	Ft.	In.
Slate, black, with plant fossils, **Sandy Huff**	4	0
Coal, soft	1	1
Slate, pavement	....	....

As stated above these widely scattered and often slaty exposures do not indicate coal of commercial character at the Castle horizon but it will furnish a limited amount of local domestic fuel.

GUYANDOT SANDSTONE.

The Guyandot Sandstone of Campbell[19], named from its exposure near the village of McGraw, Wyoming County, is present in the stratigraphic column of Webster, having been observed at various points. As a rule in this county it is massive, coarse, gray, and very hard, often making cliffs or cataracts, its thickness being 20 to 40 feet, and its position from 30 to 50 feet above the Sewell Coal and almost immediately over the Sewell "B." Its most noticeable exposure in the county is along Little Sugar Creek, Holly District, northeast of the village of Skelt, where it is partially exposed above drainage at numerous points along that stream. In Chapter IV its thickness and character are recorded in the sections for Bernardstown, Turkey Mountain, Camden-on-Gauley, Cranberry, Camp 4 on Cranberry, and Dogway.

So far as known the Guyandot Sandstone has not been quarried in Webster but its massive and durable nature would

[19]M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Survey; 1902.

make it suitable for massive masonry construction. Its position in the southern portion of the county where it crops may be found at any point by reference to Map II on which is shown the outcrop of the Sewell Coal above which the sandstone comes by the interval above named.

SKELT SHALE.

The Skelt Shale, not previously described, is a dark-gray, fissile stratum, varying from 0 to 5 feet in thickness, and coming between the Guyandot Sandstone, and the Sewell "B" Coal. At its type locality, on the north side of Sugar Creek, 0.5 mile east of the present location of Skelt Post-Office and 0.3 mile west of the mouth of Little Sugar Creek, it comes just beneath the Guyandot Sandstone and is separated from the Sewell "B" Coal by 2 feet of sandstone. At this point it contains one marine fossil, **Orbiculoidea capuliformis,** with **Naiadites elongata,** ostracods, and obscure remains supposed to have been gastropod shell-fillings identified by Dr. Price from a small collection made by the writer. So far as known definite marine fauna have not heretofore been recorded in the New River Group. The exact relationship of the shale and its associated rocks is set forth in the description of **Coal Exposure No. 581** on a subsequent page.

SEWELL "B" COAL.

The Sewell "B" Coal of Hennen[20], named from its occurrence in Wyoming and McDowell Counties where it belongs almost immediately under the Guyandot Sandstone, is present in the stratigraphic column of Webster at various points in the southern portion of the county where its horizon crops. As a rule it is thin and lenticular, varying from 0 to 3 feet, soft and columnar, its position being immediately below the Guyandot Sandstone and 10 to 35 feet above the Sewell Coal.

In **Holly District** the coal is noted in the section for Jumbo, published on page 83, having been drilled through at that point in the **John T. McGraw No. 1 (6) Boring,** its depth below the surface being 132 feet, its interval above the Sewell

[20]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, pp. 195-196 and 535-541; 1915.

Coal 15 feet, and its thickness 0′ 4″. On Elk River the coal is noted by Mr. Lemley as having been found on the north side of the river about one-half mile northwest of the mouth of Gulf Run, and about 3 miles east of Centralia, its thickness being 10′ 0″, separated into two benches by a parting of 4′ 10″ coming at the middle of the seam, as detailed in the section for Gulf Run, page 93. The following prospect was noted in the same vicinity:

Javis Brooks Prospect—No. 579 on Map II.

On Elk River, 3.3 miles east of Centralia; Sewell "B" Coal; elevation, 1063′ B.

			Ft.	In.
Shale, dark, sandy			----	----
Coal, soft	1′	8″		
Slate, black	0	4		
Coal, soft	1	5	3	5
Interval to Sewell Coal			9	0

A sample of coal (No. 34) was taken from this prospect by D. D. Teets, Jr., Assistant Geologist of the Bethlehem Steel Company, the analysis of which is published under **Mine No. 579** in the Bethlehem Steel Company table of coal analyses at the end of this chapter.

A coking test was made from a duplicate sample of the above coal by the Bethlehem Steel Company at its Maryland Plant, Sparrows Point, Md., the results being as follows, according to D. D. Teets, Jr., Assistant Geologist of the Company:

Bethlehem Steel Company, Maryland Plant.

Coking Test Report No. 10,112.

Coal: No. 53; Sewell "B;" shipped from Centralia by D. D. Teets, Jr., to E. Barnhart.

						Dried at 212° F.	
	V. M.	F. C.	Ash.	S.	P.	B. T. U.	B. T. U.
Analysis:	28.73	60.27	11.00	0.69	0.012	12,412	Ash Free. 13,947

	T. C.	H.	O.	Ratio H:O.	N.
	71.47	4.21	12.12	34.73	0.99

	CO_2	O_2	Ill.	CO.	CH_4	H_2	N	C. P.	B. T. U.	Sp. Gr.
Gas:	7.7	0.5	2.3	12.6	28.1	45.3	3.5	4.3	523	.489

Cu. Ft. Gas per gross ton 8,689 Candle Ft. per gross ton 37,322

Per cent. of coke: 74.14

Notes:

Coal: weathered.
Coke: this is a non-coking coal.

At **Coal Exposure No. 580 on Map II,** located on Sugar Creek, at the mouth of Sugar Run, just south of Skelt, the coal is exposed just above drainage, its thickness being 1′ 0″ and its elevation 1997′ B., as detailed in the section for Skelt, page 86. The following exposure was noted in the same vicinity:

Coal Exposure—No. 581 on Map II.

On Sugar Creek, 0.5 mile east of Skelt; **Sewell "B" Coal;** elevation, 2040′ B.

	Ft.	In.
Sandstone, massive, **Guyandot**	15	0
Slate, dark-gray, with marine fossils, **Skelt**	5	0
Sandstone	2	0
Coal, soft	0	10
Shale, sandy, to railroad grade	4	0

In **Fork Lick District** the Sewell "B" Coal is recorded in the section for Little Grassy Creek, page 94, having been found in the **Neal Cool No. 2 (10) Core Test,** bored at that place, its depth below the surface being 130 feet, its thickness 0′·8″, and its interval above the Sewell 25 feet. At **Coal Exposure No. 582 on Map II,** located on Leatherwood Creek, 1.1 miles southeast of Bergoo, it was noted in the mountain road,

measuring 2′ 10″ thick, at an elevation of 2785′ B., coming 30 feet above the Sewell.

At the **Jacob Fisher Prospect (No. 582A on Map II)**, located on Big Run of Elk River, 1 mile southeast of Waneta, the coal measured 2′ 6″, with an elevation of 3155′ B., as detailed in the section for Waneta, page 100.

At the **C. N. Dyer Prospect (No. 583 on Map II)**, located on Gauley River, 3.6 miles east of Bolair, it was once opened at an elevation of 2570′ B., its thickness being reported by Mr. Dyer as 2′ 0″.

In **Glade District** it is noted in the section for Camden-on-Gauley, page 115, having been found in the **J. N. Camden No. 1 (20) Oil Test** at a depth of 400 feet below the surface, its thickness being recorded as 5 feet and its interval above the Sewell Coal 54 feet.

Elsewhere in the county the coal was not observed. Its scanty and scattered exposures, and usual thin cross-section when found, would indicate that it is not sufficiently good to be classed as a minable bed but that it may furnish a limited amount of local domestic fuel at a few points.

The Sewell "A" Coal of Hennen[21], named for its occurrence in Wyoming and McDowell Counties, where it was noted at a few points, its position being 20 to 30 feet below the Sewell "B", and almost immediately above the Lower Guyandot Sandstone, was not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

LOWER GUYANDOT SANDSTONE.

The Lower Guyandot Sandstone of Hennen[22], named from its occurrence in Wyoming and McDowell Counties where it comes only a few feet above the Sewell Coal, is generally prevalent in southern Webster where its horizon crops. As a rule it is massive, medium-coarse, very hard, varying in thickness from 10 to 35 feet. It is usually separated from the

[21]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, p. 196; 1915.

[22]Ibid., pp. 196-197.

Sewell Coal by 5 to 15 feet of shale, but occasionally rests directly on the coal itself. On Elk River, 2 miles northwest of Diana, this stratum makes a prominent cliff, 50 feet thick, its elevation being 1075′ B. In the same drainage basin it is well exposed in the vicinity of Skelt, being prominent along Sugar Creek between the mouth of Sugar Run and the mouth of Sugar Creek, and making falls in the latter stream 0.4 mile above its mouth. It is also visible at various points along Back Fork of Elk just above the mouth of Sugar Creek, making cliffs only a few feet above drainage. In Chapter X various exposures are recorded under the detailed descriptions of openings in the Sewell Coal. In Chapter IV it is recorded in the sections for Tracy, Webster Springs (South), Turkey Mountain, Camden-on-Gauley, Three Forks of Williams, Snakeden Mountain, and Dogway.

So far as known the Lower Guyandot has not been quarried in the county but its massive and durable character would make it well adapted for massive masonry structures. Its position may be found at any point where it is above drainage by referring to Map II, on which is delineated the outcrop of the Sewell Coal, underlying the sandstone by an interval of only a few feet.

HARTRIDGE BLACK SHALE.

The Hartridge Black Shale of the writer[23], named from its occurrence at the mining village of Hartridge, Randolph County, where it is characterized by **Naiadites elongata** fossils in profusion, was noted at numerous points in Webster. As a rule it is dark, argillaceous or carbonaceous, and laminated, frequently having lenses of iron carbonate, and often having plant or non-marine fossils, its thickness varying from 5 to 20 feet, and its position being immediately over the Sewell Coal. At certain points the shale is cut away entirely by the Lower Guyandot Sandstone which sometimes rests directly on the coal. On Elk River, 3.7 miles east of Centralia, the shale is exposed over the Sewell Coal at the mouth of

[23]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, pp. 288-290; 1918.

Gulf Run, being 1 foot thick, ferriferous, and containing fossils. On Elk River, 0.3 mile west of Summit Station, it is exposed above the Sewell, being 8 feet thick and carrying **Naiadites,** as detailed in the section for Summit, page 88. On the mountainside south of the same stream and 1 mile south of Webster Springs, it was noted above the Sewell Coal, being 10 feet thick and carrying **Naiadites,** as detailed in the section for Webster Spring (South), page 97. On Laurel Run of Back Fork of Elk, just northwest of Breece, it is exposed just over the Sewell Coal, whose elevation is 2060′ B., the shale being 55 feet thick and carrying **Naiadites.** On Elk River, 0.3 mile northwest of Bernardstown, it is exposed above the Sewell, the elevation of which is 2345′ B., being 15 feet thick and containing **Lingulae,** as detailed in the section for Bernardstown, page 99. Near the head of Little Run of Elk, 1.5 miles southwest of Waneta, it is visible over a prospect in the Sewell Coal whose elevation is 2820′ B., being 5 feet thick, with ferriferous and limy nodules, and carrying fossils.

Farther south, on the Gauley River, it is exposed above the Sewell Coal, 0.5 mile northwest of the mouth of Laurel Creek, being 3 feet thick and containing **Naiadites,** the elevation of the coal being 2530′ B. On the same river, 0.7 mile southeast of the mouth of Laurel Creek, it is exposed over the Sewell Coal, being 5 feet thick and containing **Lingulae,** the elevation of the coal being 2565′ B. On Williams River it was noted at the mouth of Whiteoak Run, containing **Lingulae** and **Naiadites,** and coming over the Sewell Coal, at an elevation of 2560′ B. It was noted again on the main Williams River, 0.4 mile northeast of the Three Forks, carrying **Lingulae** and coming just over the Sewell Coal, at an elevation of 2740′ B., as detailed in the section for Three Forks of Williams, page 118. In the section for Camden-on-Gauley, page 115, it is reported in the **J. N. Camden No. 1 (20) Oil Test,** being 33 feet thick.

SEWELL COAL.

The Sewell Coal of White[24], named from Sewell Mountain, Fayette Couunty, and belonging in that locality about 300 feet below the Nuttall Sandstone and 60 to 80 feet above the Upper Raleigh Sandstone, is a well-developed seam in Webster, being the most valuable of all the coals of the New River Group. In this county its position varies from 100 to 250 feet above the base of the New River Group, and from 150 to 200 feet below the base of the Lower Nuttall Sandstone, being usually soft, columnar, and single-bedded, and from 2 to 60 feet in thickness. It outcrops generally along the Elk, Gauley, Williams, and Cranberry Rivers, and is usually of minable thickness, but in certain localities, as will be later detailed, it thins to less than commercial thickness. In the southern portion of the county where it crops it has been used as the base for the red structure contours shown on Map II, and on the same map its outcrop is delineated. In Chapter X it will be discussed in full, with numerous bed sections, chemical analyses, and an estimate of its areal extent and tonnage.

As indicated in a previous Report[25], it is the belief of the writer that the Sewell is the same as the **Sharon Coal** of western Pennsylvania since he has closely traced it, in conjunction with the Upper Raleigh (Sharon) Sandstone, from the Fayette County Line across Nicholas, along the Gauley River and other streams, across Webster along the Gauley and Elk Rivers and Point Mountain, across Randolph along the Rich Mountain escarpment, and across Barbour and southern Preston along the Laurel Ridge which is merely the northward extension of Rich Mountain, to the Cheat River Valley at Rowlesburg where the Pottsville has thinned down almost to its normal Pennsylvania thickness and where the Sharon Coal is exposed along the Baltimore and Ohio Railroad grade,

[24]I. C. White, The Virginias, pp. 7-16; January, 1885; Bull. 65, U. S. Geol. Survey, p. 197; 1891; and Vol. II, W. Va. Geol. Survey, pp. 657-665; 1903.

[25]Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, pp. 266 and 291; 1918.

with the fossiliferous Hartridge Black Shale above it[26] and the Sharon Conglomerate only a few feet below it, this same deduction having been long ago advanced by Dr. David White, Chief Geologist of the United States Geological Survey, from the evidence of fossil plants.

WELCH SANDSTONE,

The Welch Sandstone of Hennen[27], named from its occurrence at the town of Welch, McDowell County, and coming between the Sewell and Welch Coals, seems to be present in the stratigraphic column of Webster although it is not prominent, being massive, coarse, and gray, and varying from 10 to 35 feet in thickness. In Chapter IV it is recorded in the sections for Webster Springs (North), Webster Springs (South), Bergoo, Three Forks of Gauley, and Camden-on-Gauley. So far as known it has not been quarried in the county, but its character is such that it could be used for massive masonry if desired.

WELCH COAL.

The Welch Coal of White[28], belonging 60 to 70 feet below the Sewell Coal and 0 to 10 feet above the Upper Raleigh Sandstone at its type locality near the town of Welch, McDowell County, was noted at many localities in the region of its outcrop in southern Webster. As a rule it is soft and columnar, single-bedded, and varying in thickness from 0 to 4 feet, being frequently too thin for mining, and coming 20 to 50 feet below the Sewell Coal and only a few feet above the Upper Raleigh Sandstone. In Chapter X it is discussed in full, together with numerous bed sections, chemical analyses, and an estimate of its tonnage and extent, under the subject of "Commercial Coal", and on Map II its crop is shown for those regions in which it is known or believed to be of minable thickness.

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[26]Ibid., p. 289.

[27]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, pp. 198-199; 1915.

[28]I. C. White, Vol. II, W. Va. Geol. Survey, pp. 666-667; 1903.

There is a remote possibility that the coal correlated as the Welch in this Report may belong at the Beckley horizon instead, owing to the fact that the Welch Coal is not generally present in minable thickness in the counties of Wyoming, Raleigh, Fayette, and Nicholas which intervene between Webster and the type locality of this coal in McDowell County, while the Beckley Coal is undoubtedly of much more importance than the Welch in the neighboring county of Fayette. The writer's correlation of this coal as the Welch is based on the fact that it comes almost directly above a great sandstone horizon that seems to be well established as the Upper Raleigh, while the Beckley Coal belongs some distance below this persistent stratum. Whatever may be the merits of any discussion regarding the identity of the coal in question, its physical existence in the measures of Webster County is a fact beyond all question as its presence may be noted at numerous points in conjunction with the Sewell Coal above, and its value as a mineral asset in Webster County remains the same whether it be called Welch or Beckley.

UPPER RALEIGH (SHARON) SANDSTONE.

The Upper Raleigh Sandstone of White[29], being the upper division of the **Raleigh Sandstone** of Campbell[30], and named from its occurrence in northeastern Raleigh County, is a well-marked stratum in Webster. In this county it is massive, gray, coarse, and often pebbly, its thickness being 40 to 70 feet, its top coming 50 to 75 feet below the Sewell Coal, and its outcrop being marked by frequent cliffs. As stated in a previous Report[31] it is the belief of the writer, supported by extensive field studies, that the Upper Raleigh Sandstone is identical with the **Sharon Conglomerate** of western Pennsylvania, the evidence being apparently conclusive.

On Elk River the Upper Raleigh is visible 0.6 mile west of Summit Station, 25 feet of it being exposed above drainage, and its top having an elevation of 1210′ B. Northwestward

[29]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 198; 1908.
[30]M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Survey; 1902.
[31]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, pp. 292-293; 1918.

from this point it is visible at several points down Elk, coming only a few feet above drainage, until it finally dips below water-level at a point almost due west of Diana. On Back Fork of Elk this stratum is visible just below the mouth of Aaron Run, 1.2 miles above Breece, being 75 feet thick and making a cataract in the stream, the elevation of its base being 1765′ B., and the red Mauch Chunk Shales being visible below it. Above this cataract the ledge is below drainage for several miles due to the westward elbow of the river but near the mouth of Sawyer Run it emerges again and remains above water-level all the way to the Randolph line, being visible at numerous points and making cliffs, the reds usually showing just below it as it constitutes the basal portion of the Pottsville in this vicinity. On main Elk above Webster Springs it is visible in the Point Mountain road, 0.7 mile northeast of Ralph, its elevation being 1210′ B., and may be seen again 0.3 mile northwest of Bernardstown where it is 40 feet thick and massive, its elevation being 2255′ B. On Left Fork of Leatherwood Creek, in the narrow strip of Randolph County treated in this Report, it is visible at several points just above drainage, being massive and pebbly. On the south side of Elk, 0.9 mile southeast of Chestnut Bottom School, it makes a cliff 50 feet thick against the face of Gauley Mountain, its elevation being 2690′ B.

On Gauley River it is visible just below the mouth of Johnson Hollow and southward from the Cold Knob, making a cliff 30 feet thick and having an elevation of 2675′ B. At the Three Forks of Gauley it is massive and pebbly, the elevation of its top being 3330′ B., and east of the residence of Adam T. Dodrill, who occupies the last house up Gauley above the forks, it is visible with a basal elevation of 3520′ B., making a cliff 30 feet thick and pebbly.

In Chapter IV the Upper Raleigh is noted in the sections for Arvondale Junction, Jumbo, Summit, Webster Springs (South), Bernardstown, Bergoo, Elk Mountain, Three Forks of Gauley, Camden-on-Gauley, Camp 4 on Cranberry, and Snakeden Mountain. So far as known it has not been quar-

ried in the county, but its massive and durable nature would make it suitable for massive masonry construction.

The Little Raleigh "A" Coal of Krebs[32], named from its occurrence in Raleigh County where it comes immediately below the Upper Raleigh Sandstone, was not noted in Webster, having evidently disappeared in the northeastward thinning of the measures.

LITTLE RALEIGH COAL.

The Little Raleigh Coal of White[33], named from its occurrence in Raleigh County where it comes in the interval separating the Upper and Lower Raleigh Sandstones, appears to be only slightly represented in Webster. In the section for Redoak Knob, page 118, it is noted as a blossom, and in that for Camp 4 on Cranberry, page 120, it is represented by slate. Elsewhere it was not observed and seems to have little scientific and no economic importance in the county.

The Lower Raleigh Sandstone of White[34], being the lower division of the Raleigh Sandstone of Campbell[35], named from its occurrence in northern Raleigh County where it comes a few feet below the Little Raleigh Coal, and the **Beckley "Rider" Coal** of Krebs[36], named for its occurrence just under the Lower Raleigh Sandstone, were not observed in Webster, having evidently disappeared in the northeastward thinning of the measures.

BECKLEY COAL.

The Beckley Coal of Campbell[37], described in more detail by White[38], named from its occurrence in the vicinity of Beckley, Raleigh County, where it has been mined commer-

[32]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, pp. 332 and 361; 1916.

[33]I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 198-199; 1908.

[34]Ibid., pp. 198-199.

[35]M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Survey; 1902.

[36]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, p. 362; 1916.

[37]M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Survey; 1902.

[38]I. C. White, W. Va. Geol. Survey, Vol. II, pp. 667-668; 1903; and Vol. II(A), pp. 186-195; 1908.

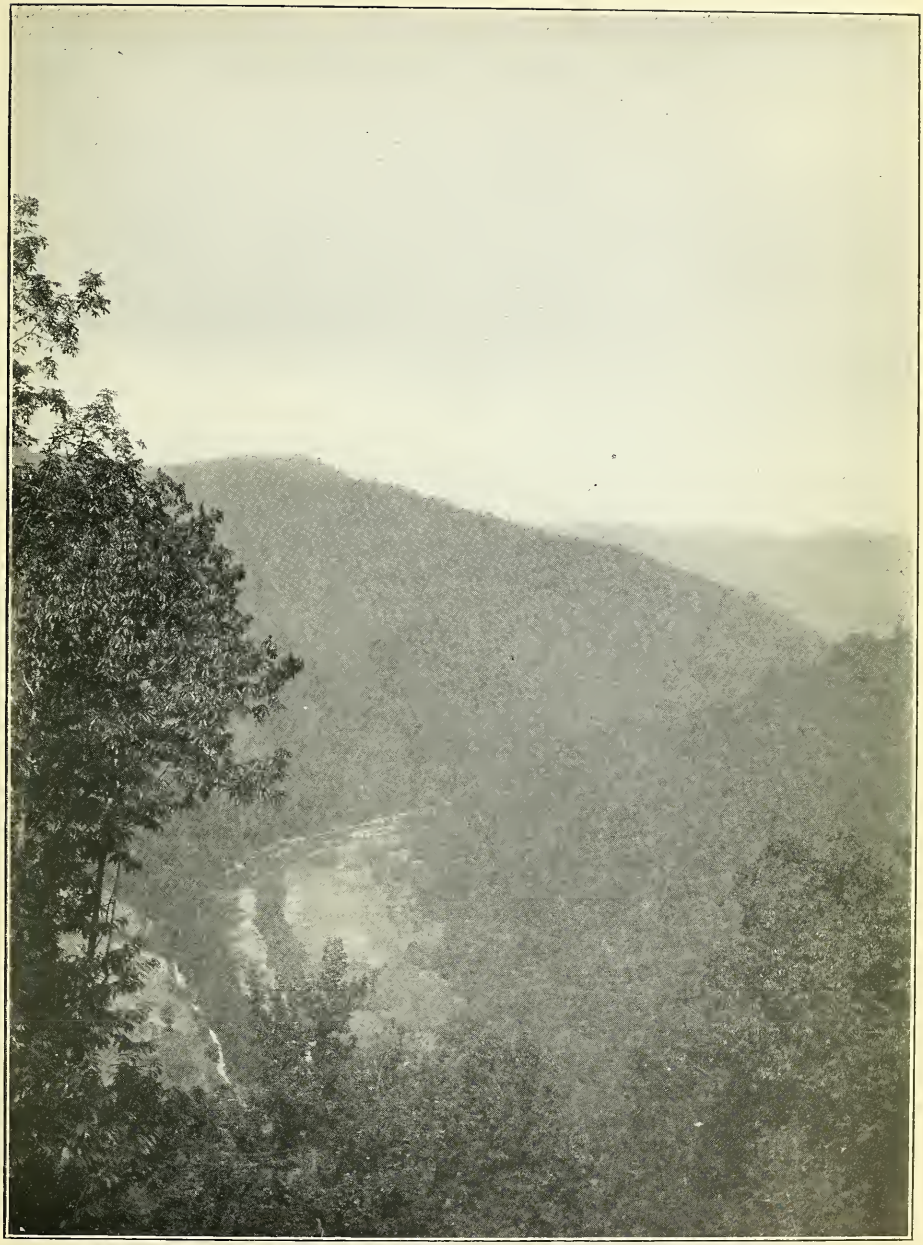

PLATE XIV.—Looking into Elk River Valley from West Virginia Midland Railroad; Topography of Pottsville Series.

cially on an extensive scale, and coming a short distance below the Lower Raleigh Sandstone, appears to be only poorly represented in Webster. It is apparently slaty and lenticular, its position being 125 to 165 feet below the Sewell. The following exposure seems to represent it, being the only place where it was fully exposed:

West Virginia Midland Railroad Exposure—No. 739 on Map II.

On Elk River along the W. Va. Midland Railroad grade, 1.1 miles west of Skidmore Crossing; **Beckley Coal**; elevation, 1640′ B.

			Ft.	In.
Shale, sandy			3	0
Coal	0′	6″		
Fire clay shale	4	0		
Coal	0	4	4	10
Fire clay and dark shale to grade			15	0

On Gauley River the Beckley Coal was once opened at the **Sol. Starcher Prospect (No. 740 on Map II)**, located in a branch immediately north of Bolair at an elevation of 2325′ B. The prospect had fallen shut but according to Mr. Starcher the seam measured more than 2′ 8″. Elsewhere in the county it was not observed, although its horizon is exposed at numerous points, thus postulating the conclusion that it has little economic value.

QUINNIMONT SANDSTONE.

The Quinnimont Sandstone of White[39], named from the town of Quinnimont, Fayette County, where it comes just under the Beckley Coal, was seldom observed in Webster. In the section for Dogway, page 122, at the southern end of the county, it is recorded as being 30 feet thick and shaly, coming 20½ feet above the Fire Creek Coal. Farther north its horizon seems to be occupied by shale.

QUINNIMONT SHALE.

The Quinnimont Shale of Campbell[40], named from the

[39]I. C. White, Vol. II(A), W. Va. Geol. Survey, p. 13, 1908.

[40]M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Survey; 1902.

town of Quinnimont, Fayette County, where it occupies the interval between the Quinnimont Sandstone and the Fire Creek (Quinnimont) Coal, seems to be present in a limited area in southern Webster. In the section for Webster Springs (North), page 95, it is recorded as being 15 feet thick and black in color, coming just over the Fire Creek Coal. In that for Dogway, page 122, it is noted as a sandy shale 20½ feet thick, coming just over an opening in the Fire Creek Coal.

FIRE CREEK (QUINNIMONT) COAL.

The Fire Creek (Quinnimont) Coal of White[41], named from its occurrence in the vicinity of Fire Creek and Quinnimont, Fayette County, where it has been mined commercially on an extensive scale, attains minable thickness in certain localities of southern Webster but is not generally prevalent. Its position in the measures of Webster varies from 100 to 200 feet below the Sewell Coal and from 10 to 40 feet above the red Mauch Chunk Shales. Its thickness varies from 0 to 8 feet and as a rule there is a considerable slate parting near the middle of the seam, though this is not always the case. The position of this coal is delineated on Map II in those regions where it is known or believed to be of value and in Chapter X it will be discussed in full, together with various bed sections and chemical analyses, and an estimate of its probable tonnage.

The Little Fire Creek Coal of White[42], named from its occurrence in Raleigh County where it is described as coming 20 to 40 feet below the Fire Creek Coal, was not observed in Webster, having evidently disappeared in the northeastward thinning of the Pottsville.

[41] I. C. White, Bull. 65, U. S. Geol. Survey, p. 197; 1891; and Vol. II(A), W. Va. Geol. Survey, pp. 179-185; 1908.

[42] I. C. White, Vol. II(A), W. Va. Geol. Survey, pp. 22 and 25, 1908.

PINEVILLE SANDSTONE.

The Pineville Sandstone of Hennen[43], named from its occurrence at Pineville, Wyoming County, where it comes directly above the No. 9 Pocahontas Coal, is the basal member of the Pottsville definitely correlated in Webster, its position being only a few feet below the Fire Creek Coal and just above the red Mauch Chunk Shales. In the section for Camden-on-Gauley, page 115, it is noted in the oil test at that place as being 47 feet thick, white and hard, and its base being 212 feet below the Sewell Coal. On the Cranberry River, 0.5 mile above the Webster-Nicholas line it was observed in the bed of the river, its top having an elevation of 2255′ B., coming at an interval of 230 feet below the bench of the Sewell Coal. Elsewhere it was not observed, and it probably is not present in the central or northern portion of the county.

[43]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, pp. 211-212; 1915.

CHAPTER VIII

THE MAUCH CHUNK AND GREENBRIER LIMESTONE SERIES.

GENERAL ACCOUNT AND SECTION, MAUCH CHUNK SERIES.

The **Mauch Chunk Series,** composing the upper division of the Mississippian Rocks, and named for its occurrence near the city of that name in eastern Pennsylvania, and coming just below the Pottsville, is exposed along several of the deep river valleys in eastern Webster and in the strip of Randolph under discussion in this Report. In this territory it is composed of red and green shales, interstratified with green and flaggy or shaly, lenticular sandstones, and has in the eastern portion a large conglomerate member near the top and two well-defined marine fossiliferous limestone horizons and two lenticular streaks of coal. Its thickness varies from 500 feet at the Webster-Braxton line, where it has been recorded in an oil well test (16) at Centralia, to 1500 feet along the Pocahontas line at the southeastward edge of the area, there being a rapid southeastward thickening all the way across the county. At Webster Springs, where the full series is exposed, it is about 700 feet thick, an accurate vertical measurement being impossible at that point on account of the rapid dip of the strata. The red sediments, which compose the great bulk of the series, contain from 5 to 10 per cent. of iron which has been completely oxidized in the process of aerial, or subaerial, action, these materials having been apparently subjected to long exposure in the eastern mountain masses from which they came, it being probable, also, that there was further atmospheric action at intervals during the process of deposition.

The Mauch Chunk in Webster is principally exposed along the deep valley of Elk River, which has cut a channel

to a much lower level than the adjacent rivers, there being no exposures north of this stream. As defined on Map II the series first outcrops on Elk, 3.1 miles northwest of Webster Springs, and rises southeastward along the valley to Webster Springs where its full thickness is visible, and its main body remains above drainage all the way to the Pocahontas line, a few feet of the lower portion being at times under the level of Elk. On the Gauley it rises above water-level just east of Bolair and so continues eastward to the Pocahontas line, only the upper portion being exposed. On Williams it first appears 0.5 mile east of Dyer and its upper portion remains above drainage all the way to the Pocahontas line at the Bannock Shoals. On Cranberry it rises above drainage 1.2 miles southeast of the Bishop Knob, and its upper portion remains exposed eastward to the Pocahontas line.

In Chapter IV the partial or entire thickness of the Mauch Chunk is recorded in the sections for Arvondale Junction, Bergoo, Bernardstown, Big Spruce Knob, Camden-on-Gauley, Cleveland, Elk Mountain, Jumbo, Redoak Knob, Snakeden Mountain, Three Forks of Gauley, Three Forks of Williams, Turkey Mountain, Webster Springs (North), and Webster Springs (South).

Economically, the Mauch Chunk Series has little present value except as a soil maker, its sandstones being, as a rule, too flaggy or shaly to be utilized for building purposes, and its two streaks of coal being too thin and lenticular to repay the labor of prospecting them. There is a possibility, however, that many years in the future the iron content of the red shales may be of value when the richer deposits of the world approach exhaustion, as their ultimate utilization would be favored by the presence of an abundant supply of coal in the mountains above them and the Greenbrier Limestone cropping at their base, thus comprising an unusual natural assembly of all the essential elements of blast-furnace reduction, the same conditions being true of only a few of the iron mining regions of the world. These red shales could also be utilized for brick making, their rich red color being much desired for building purposes, and their use for local road pur-

poses being justified by the low cost of manufacture and shipments, as compared to more durable fire-brick that would have to be imported from other regions.

The following general section, compiled from the measured sections of Chapter IV and from other local observations, exhibits the main features of the series as it occurs in Webster and the adjoining region of Randolph and western Pocahontas:

General Section of the Mauch Chunk Series for Webster County.

	Thickness Feet	Total Feet	
Shale, red or green	50 to 100	100	
Sandstone, Princeton Conglomerate, massive, greenish-gray, very hard and pebbly, great conglomerate of upper Elk, Gauley, Williams, and Cranberry Rivers	30 to 150	250	250′
Limestone. Terry, shaly and lenticular, usually contains marine fossils in profusion	0 to 5	255	
Shale, variegated and sandy, lenticular	0 to 5	260	
Shale, Pluto, dark, carbonaceous, lenticular, sometimes cherty, with plant or marine fossils	0 to 4	264	
Coal, Pluto, soft, lenticular, visible at a few points on upper Elk	0 to 1	265	15′
Shales, red or green, with numerous green lenticular sandstones, usually flaggy or shaly but sometimes massive	370 to 648	913	
Sandstone, Big Spruce Knob, green, flaggy	0 to 30	943	
Shale, Big Spruce Knob, gray, with plant fossils	0 to 2	945	
Coal, Big Spruce Knob, medium-soft, double-bedded (prospected on head of Williams River, Pocahontas County)	0 to 5	950	685′
Shale, red or green, with lenticular green sandstones	0 to 310	1260	
Limestone, Hinton, shaly, with marine fossils	10 to 40	1300	
Shale, red or green, with lenticular sandstones	20 to 50	1350	
Sandstone, Webster Springs, greenish-gray, massive or current-bedded	20 to 150	1500	
Greenbrier Limestone	....	.....	

DESCRIPTION OF MEMBERS, MAUCH CHUNK SERIES.

PRINCETON CONGLOMERATE.

The Princeton Conglomerate of Campbell[1], named from its occurrence at the town of Princeton, Mercer County, where it belongs 800 feet below the base of the Pottsville and 2500 feet above the Greenbrier Limestone, is found generally throughout southeastern Webster in the region of its outcrop. In this county it is usually separated from the Pottsville by an interval of 50 to 100 feet, composed mostly of red or green shale. As a rule it is massive, very hard, greenish-gray, and contains many quartz pebbles of one-fourth to one inch diameter and of irregular and often angular shapes, scattered throughout its mass, its thickness varying from 30 to 150 feet.

In Chapter IV it is noted in the sections for Webster Springs (North), Bernardstown, Elk Mountain, Turkey Mountain, Three Forks of Gauley, Camden-on-Gauley, Red-oak Knob, Three Forks of Williams, Snakeden Mountain, and Big Spruce Knob. On Elk River it makes a massive cliff, 60 feet thick, along the West Virginia Midland Railroad, 0.5 mile west of Skidmore Crossing, its elevation being 1585′ B. On the south side of the same stream it makes a cliff on the right branch of Kingfisher Creek, its top having an elevation of 1860′ B., and coming 190 feet below the Sewell Coal. On the same side of Elk it is visible along the old Cowen road (now abandoned), 0.8 mile southwest of Webster Springs, being 40 feet thick, massive, and its basal elevation being 2120′ B., making an interval of 145 feet below the base of the Pottsville. On the Back Fork of Elk, just east of Breece, it makes a cataract 20 feet high, as it goes under drainage, its top having an elevation of 1730′ B., and there being numerous pebbles in its mass. On the south side of main Elk, 1.9 miles southeast of Webster Springs, it makes a cliff 30 feet thick, its elevation being 2210′ B. On the north side of Elk, 0.6 mile northeast of Ralph, it is visible along the public road, being

[1]M. R. Campbell, Pocahontas Folio, No. 26, U. S. Geol. Survey; 1896.

35 feet thick, massive, and gray, having an elevation of 2215′ B. Between the forks of Leatherwood Creek, 3.2 miles southeast of Bergoo village, it was noted at an elevation of 2550′ B., making a 30-foot cliff, carrying numerous large, quartz pebbles, and coming 430 feet below an opening in the Sewell Coal. On Left Fork of Leatherwood, 3.5 miles southeast of Bergoo, it makes a great cliff 60 feet thick at an elevation of 2600′ B., and makes a cataract in the stream at the same place. Farther up the same stream it is visible at various points, being pebbly at most places.

On the Gauley River it first appears above drainage near the mouth of Straight Creek and from that point eastward to the Pocahontas line it is a conspicuous ledge, sometimes being partly under drainage, and being a conglomerate of enormous proportions. At the Three Forks of Gauley, as shown by the section for that locality, published in Chapter IV, it is 145 feet thick and very pebbly. Just above the forks it is visible immediately under the residence of Adam T. Dodrill, the river making rapids through it at that point. On the Williams River it appears above drainage 2 to 3 miles above Dyer and is a conspicuous horizon nearly all the way to the Pocahontas line at the Bannock Shoals, the foot trail up the south side of the river following along its top for several miles. Between the Upper Bannock Shoals Run and Bridge Branch, 0.8 mile above the Webster-Pocahontas line, the following measurement was made on the south side of the river at the "Big Rock" of local fame:

	Ft.	In.
Sandstone, massive, cliff rock, with large pebbles, Princeton (2870′ B.)	40	0
Shale, red	55	0
Sandstone, flaggy, in river	....	..

On the Cranberry River it comes above drainage not far above the mouth of Aldrich Branch which is just southeast of the Bishop Knob, and is a conspicuous horizon for many miles up the river to the Pocahontas line. At the mouth of Lick Branch, 2.3 miles north of the Hanging Rock, it is visible on the north side of the river, being 10 feet above railroad grade, its elevation being 2585′ B., and its thickness 85 feet.

So far as known the Princeton Conglomerate has not been quarried in the county. Its extremely conglomeratic character would make it usually unsuitable for anything except rough, massive masonry.

According to Hennen[2] the Princeton Conglomerate may possibly correlate with the **Maxton Oil Sand** of northern West Virginia, and its wide-spread occurrence and its position in the series would tend to strengthen this conclusion.

TERRY LIMESTONE.

The **Terry Limestone** of Krebs[3], named from its exposure at the town of Terry, Raleigh County, where it comes 346 feet below the base of the Pottsville and just under what appears to be the Princeton Conglomerate, and where it is described as being 1 foot thick, with marine fossils, is apparently as well developed in Webster as at its type locality. In this county it is shaly or hard and gray, sometimes cherty, lenticular, varying in thickness from 0 to 5 feet, its position being only a few feet below the Princeton Conglomerate, and 150 to 300 feet below the base of the Pottsville.

On Elk River it was noted along a mountain road just east of Leatherwood Creek and 0.5 mile southeast of Bergoo village, where, as exhibited in the section for Bergoo, page 102, this stratum is visible, being 5 feet thick and shaly and carrying marine fossils in profusion, **Producti, Derbya,** and other forms being recognized, its elevation being 2480′ B., its interval below the Sewell Coal being 275 feet, and that below the base of the Pottsville 175 feet. On Left Fork of Leatherwood Creek the following exposure was noted at a point 3.5 miles southeast of Bergoo village:

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[2]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, pp. 249-250; 1915.

[3]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, p. 69; 1916.

	Ft.	In.
Sandstone, massive, great pebbly conglomerate, makes falls, Princeton (2595′ B.)	60	0
Slate, dark-gray	4	0
Limestone, shaly, with profuse marine fauna, mostly Pelecypoda, Terry	2	0
Shale, variegated and sandy	5	0
Shale, black, with Lingulae, Pluto	0	4
Shale, gray	2	0
Slate, black, coaly, Pluto Coal horizon (Exposure No. 756 on Map II)	0	4
Shale, sandy	..	..

The section above reveals the entire stratigraphic stage of the Princeton Conglomerate, Terry Limestone, and Pluto Coal, as well as showing another distinct marine horizon which from its relationship to the Pluto Coal and its entirely distinct type of fossils should be called the **Pluto Shale**, as will be later described.

On the Back Fork of Elk, 1.9 miles east of Webster Springs, a shaly limestone, 1 foot thick, with an elevation of 2040′ B., was noted on a spur of Point Mountain, and probably represents the Terry, its interval below the horizon of the Sewell Coal being about 140 feet.

On the north side of Gauley River the following exposure was noted 4 miles southeast of Bolair:

	Ft.	In.
Sandstone, massive, cliff, Princeton? or Upper Raleigh?	50	0
Shale, red	5	0
Limestone, cherty, with pyrites and marine fossils, Terry (2348′ B.)	2	0
Shale, red	10	0
Concealed to Gauley River	10	0

In the above section there is some doubt as to the massive sandstone ledge at the top being the Princeton, as its appearance more closely resembles the Upper Raleigh of the Pottsville, and the presence of red shale between the sandstone and the Terry Limestone would favor the possibility of the Princeton being locally absent. The interval from the Sewell Coal down to the Terry Limestone at this point is 217 feet. A short distance farther up Gauley the Terry Limestone was observed again on Turkey Creek, 0.2 mile above its mouth, being cherty, fossiliferous, and 0′ 2″ thick, with an

elevation of 2350′ B., and separated from the same sandstone stratum noted above by a concealed and red shale interval of 30 feet. On the south side of Gauley, 0.2 mile above the mouth of Turkey Creek, the following exposure was noted:

	Ft.	In.
Interval from Sewell Coal	141	0
Sandstone, thickness concealed, Princeton? or Upper Raleigh?	....	....
Shale, red	22	0
Limestone, cherty?, Terry	3	0
Shale, red, to Gauley River	20	0

The limestone at this point had the appearance of being cherty although it was impossible to reach it for examination owing to its location in a perpendicular bluff. As stated above it may be possible that the sandstone just above the red shale is the Upper Raleigh, instead of the Princeton, and the writer is rather inclined to this belief. It is also possible that the cherty limestone noted in the last three exposures may represent a distinct fossiliferous stratum coming above instead of below the Princeton, but it seems more probable that it is the same as the Terry Limestone found on Elk, and that the Princeton Conglomerate is locally absent in this vicinity.

Illustrating the wide persistence of the Terry Limestone through the mountain counties of the State, the following exposure is published, having been recently noted on the northern bank of Fishinghawk Creek of Cheat River, about one mile west of Bemis, Randolph County, and 35 miles northeast of Bergoo:

	Ft.	In.
Sandstone, massive, pebbly, Princeton	40	0
Concealed and red shale	40	0
Sandstone, shaly	15	0
Shale, greenish-gray, with ferruginous limestone and marine fossils, to creek bed, Terry Limestone (2690′ B.)	10	0

PLUTO SHALE.

The Pluto Shale, not previously described, is a black, fissile carbonaceous shale, carrying **Lingula** fossils, and occurring on the Left Fork of Leatherwood Creek of Elk, 3.5 miles southeast of Bergoo, as published in a section under

the description of the Terry Limestone, page 218. At that point it is 0′ 4″ thick, coming 2 feet above the Pluto Coal horizon, 11 feet below the Princeton Conglomerate, and 5 feet below the Terry Limestone, its elevation being 2584′ B.

PLUTO COAL.

The Pluto Coal of Krebs[4], first noted in Raleigh County where it occurs not far below the apparent horizon of the Princeton Conglomerate, was noted at several points on the upper Elk in Webster. In this county its interval below the Princeton Conglomerate varies from 0 to 10 feet, the Terry Limestone and Pluto Shale occurring between them in some localities. As observed in the county it is a soft coal, less than 1 foot thick and decidedly lenticular in its occurrence. At **Coal Exposure No. 756 on Map II,** located on Left Fork of Leatherwood Creek, 3.5 miles southeast of Bergoo village, it is represented by a black, coaly slate, 0′ 4″ thick, as already exhibited in a section descriptive of the Terry Limestone, page 218. At the following point the coal was once prospected and furnished a winter's supply of fuel for the residence of Henry Hamrick:

Henry Hamrick Prospect—No. 757 on Map II.

On the south side of Elk River, 2.6 miles northeast of Bergoo village; **Pluto Coal**; elevation, 2520′ B.

	Ft.	In.
Interval from Welch Coal, including about 100 feet of visible red shale	242	0
Shale, dark, with plant fossils, **Pluto**	2	0
Coal, soft, Pluto	0	11
Slate, pavement	.....	....

A sample (201R) collected from this opening showed the following analysis according to Hite and Krak:

	Per cent.
Moisture	0.57
Volatile Matter	27.48
Fixed Carbon	44.39
Ash	27.56
Total	100.00
Sulphur	7.06
Phosphorus	0.134

[4]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, pp. 74 and 635; 1916.

It would seem from the above analysis that this stratum might serve as a source for sulphur in the manufacture of sulphuric acid.

At the **West Virginia Pulp & Paper Company Prospect (No. 758 on Map II),** located on the northeastern slope of Elk Mountain, between main Elk and Valley Fork, and 1.6 miles southwest of Blue Spring, Mingo District, Randolph, the Pluto Coal was once opened, as exhibited in the section for Elk Mountain, page 104, its elevation being 3660′ B., its interval from the Sewell Coal 390 feet, and from the base of the Pottsville 240 feet, but had fallen shut, little coal being evident on the dump.

On the Cranberry River a trace of this coal was noted at the mouth of Lick Branch, 2.3 miles north of the Hanging Rock, there being spars of coal bedded in the base of the Princeton Conglomerate which crops near the railroad grade at that point, as previously described.

It is apparent from the above exposures that little in the way of fuel can be expected at the Pluto Coal horizon, but its occurrence in the midst of the Mauch Chunk Reds, where coal of any kind is only rarely found, gives it a scientific interest of more importance than any economic value that it could possibly have.

BIG SPRUCE KNOB SANDSTONE.

The Big Spruce Knob Sandstone, not previously described, is a greenish-gray, flaggy stratum, deriving its name from Big Spruce Knob, Edray District, Pocahontas County, at whose base it crops, along the north side of Williams River, 6.5 miles northwest of Marlinton, its stratigraphic position at that point being 750 feet below the Princeton Conglomerate, 837 feet above the top of the Greenbrier Limestone, and about two feet above the Big Spruce Knob Coal. At the point where this sandstone was noted, five miles east of the Webster line, its base contains numerous plant fragments, one of which, more perfect than the rest, was forwarded, through the State Geologist, to Dr. David White, Chief Geologist of the United States Geological Survey, one

of the foremost authorities on Carboniferous paleobotany in the world, whose very interesting communication is published below:

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
WASHINGTON

June 1, 1918.

Dr. I. C. White, State Geologist,
West Virginia Geological Survey,
Morgantown, W. Va.

Dear Doctor White:

"The Calamarian fragments from the Mauch Chunk shale series, 1270 feet below the base of the Pottsville, and 832 feet above the top of the main mass of the Greenbrier Limestone at a coal prospect about 8 miles northwest of Marlinton, in Pocahontas County, West Virginia, collected by Mr. D. B. Reger and forwarded in accordance with your letter of May 14, have been examined with great interest.

"The pith casts show the node features and continuity of the ribs, characteristic of **Asterocalamites scrobiculatus** (formerly **Bornia radiata**), in form as nearly typical as I have yet seen from the Mississippian. The internodes are a little short but the narrowness and transversely linear character of the constriction, as though the pith had been slightly drawn by a thread encircling it, are typical of this species. On the other hand, most of the specimens which have been described and even recorded in the paleobotanical literature of this country are far from typical. Some of the specimens have been found upon examination to represent types with thin cortical and woody zones with predominant alternation of the ribs at the nodes. On the whole, the records in our literature of the distribution of **Asterocalamites** in the States, and in fact all North America, are very unreliable.

"Is it not possible that the zone of thin coals resting on old soils with land plants from which these fossils were obtained may be the same as that found to carry coals, coaly streaks, or soils and land plant remains near the old Abbs Valley Station on the Norfolk & Western R. R. between Bluefield and Bluestone Junction, and below the southeast escarpment of the coal fields 10 or 15 miles east or northeast of Webster Springs? As a working hypothesis at least does it not seem reasonable to assume that this region of uplift and exposure is rather extensive in the central Appalachian Valley, and that the diastrophic movement may be found to constitute a significant and possibly reliable feature of the stratigraphy and of Mississippian history in the Appalachian region?

"From several localities in western Kentucky, Mr. Chas. Butts collected, in a sandstone, plant remains almost certainly contempora-

neous with those found in the cut at Abbs Valley, Va. Evidence also points toward possible contemporaneity of plant-bearing sandstones in Alabama.

"Were there no small fragments of a small species of **Cadiopteris** found associated with the coal? Surely fragments of some sort of fernlike plants should be found.

"On rereading the letter I notice that the last paragraph refers to the Pluto Coal found by Mr. Reger in northeastern Webster County. You evidently have the same idea as that above regarding the continuity and significance of a persistent coal horizon in this zone of the Mauch Chunk.

"Thanking you for the privilege of examining the specimens, which I return to you under separate cover, I am, with best regards,

"Very truly yours,

(Signed) David White, Chief Geologist."

Answering the quite natural query and inference of Dr. David White, as expressed in the above letter, to the effect that the coal (now classified by the name of Big Spruce Knob) occurring just below the Big Spruce Knob Sandstone in which the plant fossils were found, might be the same as the Pluto Coal occurring on Elk River near Bergoo and about 10 miles above Webster Springs, attention is called to the fact that the Pluto Coal comes only a few feet below the Princeton Sandstone and 250 feet or less below the base of the Pottsville while the Big Spruce Knob Coal is at a stratigraphic level nearly 700 feet lower in the Mauch Chunk Series and 550 to 832 feet from its base, as reference to the Big Spruce Knob Section, page 123, and the general Section of the Mauch Chunk Series, page 214, will clearly show.

BIG SPRUCE KNOB SHALE.

The Big Spruce Knob Shale, not previously described, and deriving its name from its position between the Big Spruce Knob Sandstone and Big Spruce Knob Coal, as it occurs at the type locality of those two members on Williams River, Edray District, Pocahontas County, 6.5 miles northwest of Marlinton, is a gray, argillaceous stratum, apparently varying in thickness from 0 to 2 feet. In view of the question raised by Dr. David White in the above published letter regarding the possible presence of **Cadiopteris** above the Big

Spruce Knob Coal it is most unfortunate that the mouth of the prospect had so fallen shut that only slight fragments of this shale could be obtained at the time of the writer's visit.

BIG SPRUCE KNOB COAL.

The Big Spruce Knob Coal, not previously described, and taking its name from the Big Spruce Knob on the head of Williams River, Edray District, Pocahontas County, 6.5 miles northwest of Marlinton, is a carboniferous stratum that occurs at an approximate interval of 700 feet below the base of the Princeton Conglomerate, 832 feet above the top of the Greenbrier Limestone, and only a few feet below the Big Spruce Knob Sandstone, being separated from the latter by the Big Spruce Knob Shale. Most unfortunately the prospect once made at this point had fallen shut previous to the visit of the writer and a personal examination was possible only of the coal that lay on the dump where it had the appearance of a soft deposit but showed the effect of much oxidation. The following section of the coal is reported by Mr. Hubert Echols, of Marlinton, an officer of the company on whose land it was found, the prospect having been made under his supervision:

Pocahontas County Coal and Land Company Prospect—No. 759 on Map II.

On Williams River, Edray District, Pocahontas County, at the southwest base of Big Spruce Knob 6.5 miles northwest of Marlinton; Big Spruce Knob Coal; elevation, 3615′ B.

		Ft.	In.
Sandstone, Big Spruce Knob		30	0
Shale, gray, Big Spruce Knob, 2′ to		0	0
Coal	1′ 10″		
Parting	1 6		
Coal	1 6	4	10

A sample (No. 4Rc), collected from the oxidized fragments on the dump, showed the following analysis according to Hite and Krak:

PLATE XV.—Elk River Valley looking southwest toward Big Run; Johns Point in foreground; Topography of Mauch Chunk Series.

	Per cent.
Moisture	0.91
Volatile Matter	25.81
Fixed Carbon	38.29
Ash	34.99
Total	100.00
Sulphur	2.78
Phosphorus	0.040

It is the opinion of the writer that this prospect represents a lenticular deposit since it was found above drainage nowhere within the limits of Webster County and nowhere else in the immediate region of its type locality, much of this country being familiar ground. It is possible, however, that a six-inch stratum of coal reported as occurring on Redlick Run of Valley Fork of Elk, about one mile northwest of Blue Spring, Randolph County, but never verified by the writer, may represent this same horizon. It is also possible that a streak of black shale or coal reported in the C. P. Dorr No. 1 (17) oil test well at Webster Springs, occurring 860 feet below the top of the Mauch Chunk, 35 feet above the Greenbrier Limestone, and being 4 feet thick, as recorded in the section for Webster Springs (South), page 97, may represent the same stratum. In any case its development to the proportions named above seems to be largely local but nevertheless a most interesting phenomenon.

HINTON LIMESTONE.

The Hinton Limestone of Krebs[5], recorded at its type locality in the vicinity of Hinton, Summers County, as occurring about 1400 feet below the top of the Mauch Chunk Series, and carrying great numbers of marine fossils, is apparently represented in Webster by a shaly, fossiliferous stratum, 30 feet thick, noted along main Elk on the western slope of Elk Mountain, 2.2 miles southwest of Blue Spring, as recorded in the section for Elk Mountain, page 104, its interval from the top of the Mauch Chunk being 1470 feet, and from the top of the Greenbrier Limestone 140 feet.

[5]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, pp. 75, 76 and 88; 1916.

It is apparently this stratum that rises above the bed of Elk River 0.4 mile east of the Upper Elk School and 1.5 miles southwest of Samp, and showing at frequent points between that exposure and the Webster-Randolph line at the Whitaker Falls, as the massive sandstone which comes at a short interval below it is quite evidently in the Mauch Chunk Series. It is recorded in the section for Samp, page 101, being 60 feet thick and coming just above drainage. On the head of Williams River, Edray District, Pocahontas County, it appears to be the same limestone recorded in the Pocahontas County Coal and Land Company No. 1 (24) Oil Test Well, as published in the section for Big Spruce Knob, page 123, being 50 feet thick, and coming 1500 feet below the top of the Mauch Chunk, and 377 feet above the Greenbrier Limestone. In the section for Camden-on-Gauley, page 116, the same limestone appears to be represented in the record of the J. N. Camden No. 1 (20) Oil Test Well, being 57 feet thick and coming 760 feet below the top of the Mauch Chunk, and 131 feet above the top of the Greenbrier Limestone. Its apparently general occurrence over a considerable area has led the writer to believe that it may possibly be identical with the "Little Lime" of the oil well records of the northern part of the State, a stratum that is known to be present over a considerable portion of the oil fields and being only a few feet above the top of the Greenbrier. In this connection, however, it is well to note that in the well at Camden-on-Gauley a three-foot stratum of hard limestone is recorded only fifteen feet above the Greenbrier and this may possibly represent the "Little Lime."

WEBSTER SPRINGS SANDSTONE.

The Webster Springs Sandstone, not previously described, is a massive or current-bedded, greenish-gray, micaceous, and medium-hard sandstone, deriving its name from its occurrence on the north side of Elk River at the southeastern edge of the town of Webster Springs, where it is visible between the highway and the river, making a cliff 50 to 75 feet thick, at "Lover's Leap", the base of the ledge being apparently just below drainage and coming just above the top of the Greenbrier Limestone. It is this ledge which makes a series of low cascades, 10 to 15 feet high, at the Cherry Falls of Elk, just southeast of Webster Springs. Farther up Elk the same member is a prominent cliff-maker at numerous points through Webster and Randolph to the Pocahontas line. Near the mouth of Deep Run, 2.7 miles southeast of Webster Springs, it forms a great cliff, 80 to 100 feet thick, the base being concealed below drainage. At the mouth of Leatherwood Creek it makes a great cliff on the north side of Elk opposite the village of Bergoo, there being 100 feet of it visible above drainage. It is this same member that forms the Whitaker Falls at the Webster-Randolph line, the following exposure being obtained at that point:

		Ft.	In.
Sandstone, massive, to river level at top of upper cataract ..... 50'	Webster Springs.....	80	0
Sandstone, in upper falls..... 15			
Sandstone, in lower falls..... 15			
Greenbrier Limestone, visible in river below lower falls (top, 2155' B.).....		....	....

In that strip of Randolph treated in this Report, the Webster Springs Sandstone makes a cliff at numerous points along Elk between the Whitaker Falls and the Pocahontas line at the mouth of Douglas Fork, its southeastward rise being only slightly greater than the rise of the river level, so that at the mouth of Douglas Fork its base is only 60 feet above drainage, its position being just above the massive Greenbrier Limestone.

It is possible that the Webster Springs Sandstone may

be the same horizon as the **Hinton Sandstone** of Krebs[6], occurring 505 feet below the Hinton Limestone and at an unknown interval above the Greenbrier, but the available facts do not favor this idea as the two sandstones differ materially in their character and the Webster Springs Sandstone, in addition, is always found in close contact with the Greenbrier Limestone.

GENERAL ACCOUNT, GREENBRIER LIMESTONE.

The Greenbrier Limestone, named for its occurrence along the Greenbrier River in West Virginia, and corresponding to the St. Louis, Maxville, and Mountain Limestone of various surrounding State Surveys in the Appalachian Basin, and coming between the Mauch Chunk Red Shales above and the Pocono Sandstone Series below, consists mainly of hard, gray limestone, with abundant marine fauna, occasionally interstratified with streaks of red shale or sandstone. In Webster it varies in thickness from 100 feet at Centralia, along the northwestern edge of the county, as shown by the record of an oil test well (16) at that place, to about 500 feet along the southeastern edge next to Pocahontas County, there being a rapid southeastward thickening at an apparently uniform rate across the county. It is characterized by marine fossils in profusion, Crinoids and Brachiopods being among the more prominent types. It is almost entirely below drainage in the county, its only exposures being along the deep valley of Elk River from Webster Springs eastward, as shown by Map II, its outcrop continuing across the narrow strip of Randolph treated in this Report.

DETAILED EXPOSURES, GREENBRIER LIMESTONE.

As indicated above all information concerning the Greenbrier in northern and western Webster is that contained in the records of a few tests that have been made for oil and gas. The following table gives a list of such well records as are available showing its thickness in Webster or in adjacent territory:

[6]C. E. Krebs, Raleigh Report, W. Va. Geol. Survey, p. 77; 1916.

Table of Well Records Showing Greenbrier Limestone.

(+ sign indicates elevation above sea-level. — sign indicates depth below sea-level.)

No. on Map II	Surface Elevation	Property	Location	Greenbrier Limestone		
				Depth to top. Feet	Tidal elevation of top. Feet	Thickness. Feet
2	1220′ B.	Vandervort & Pickens No. 1	Jerry Run of Little Kanawha River, 1 mile S. W. of Cleveland	1285	—65	165
13	2265′ B.	Mayton Lumber Co. No. 4903	Buckhannon River at Arvondale Junction (Randolph Co.)	1281	+984	60
16	953′ L.	Centralia Imp. Co. No. 1	Elk River at Centralia (Braxton County)	960	—7	100
17	1430′ B.	C. P. Dorr No. 1	Elk River, 0.9 mile below Webster Springs	109	+1321	254
20	2020′ L.	J. N. Camden No. 1	Gauley River at Camden-on-Gauley	1648	+372	302
21	2070′ B.	Floyd Morton No. 1	Strouds Creek, 1.3 miles N. W. of Camden-on-Gauley	1637	+433	405
24	3390′ B.	Pocahontas Co. Coal and Land Co. No. 1.	Williams River, 6.5 miles N. W. of Marlinton, (Pocahontas County)	607	+2783	546

At Webster Springs where the Greenbrier first appears above drainage, the following exposure was noted on the south side of Elk opposite the Webster Springs Hotel:

	Ft.	In.
Sandstone, massive, **Webster Springs**	15	0
Shale, red, to base of Mauch Chunk Series (1460′ B.)	30	0
Limestone, gray, fossiliferous, Greenbrier, to railroad grade	7	0
Concealed to Elk River	15	0

At the Salt Sulphur Spring on the hotel grounds the limestone is visible, the spring itself deriving its supply of water from a boring made into the lime.

Just above Webster Springs the lime is depressed below drainage by the Kovan Syncline and does not reappear in the county except at the Whitaker Falls at the Webster-Randolph line where it is visible in the bed of Elk below the lower cataract. Above the Whitaker Falls, in Randolph County, the Greenbrier remains above drainage all the way to the Pocahontas line, making frequent cliffs of solid, gray limestone 40 to 60 feet thick, at frequent points, and coming just below the massive Webster Springs Sandstone. At the mouth of Douglas Fork (Pocahontas line) it makes a cliff 60 feet thick, the elevation of its top being 2545′ B. On Valley Fork of Elk, Randolph County, the top of the lime is visible at various points, rising gradually toward Blue Spring and Monterville.

PART III.

Mineral Resources.

CHAPTER IX.

PETROLEUM AND NATURAL GAS.

GENERAL STATEMENT.

Webster County is situated southeast of the main proved oil and gas belt of the State. Its northwest corner is approximately twelve miles from the gas fields of Orlando and Burnsville in Lewis and Braxton Counties west of which region the occurrence of oil and gas is known to be general along the minor anticlines and synclines that are roughly parallel to the Appalachian Geosyncline which passes through the western edge of the State in a northeast-southwest direction. Southeast of the region of Orlando and Burnsville a few light pools of oil and occasional gas wells have been found but many of the tests have proved barren, thus lending weight to the pronounced opinion of many petroleum geologists and operators that oil and gas will not be found in quantity in counties that, like Webster, lie far removed from the axis of the great Appalachian Basin, the belief being often expressed that these counties lie so near the region of violent orogenic disturbance as evidenced by the Alleghany Mountain uplifts that whatever liquid or gaseous hydrocarbons their rocks once contained have mostly escaped in volatile form through cracks and fissures and along the upturned exposed edges of the strata in the Greenbrier and other mountain valleys.

In Webster six deep tests have been drilled, all of them having been located in the northwestern half of the county. Of these tests four are reported to have had shows of gas and

two are recorded as dry holes, oil being found in none of them. While these tests are discouraging an inspection of Map II will reveal the fact that most of them were made without apparent consideration of the surface structure and their results are inconclusive rather than final. The four records available show many of the oil sands present in good development and in addition to this favorable feature considerable gas has been found in northern Nicholas County. A small oil field was tapped many years ago in the southern panhandles of Lewis and Upshur Counties, and some good gas wells have been drilled in the vicinity of Craddock in the latter county, these various localities being ranged in a semicircle around the northwestern half of Webster. An additional circumstance worthy of note is that oil and gas seepages are reported in the Big Lime along the valley of the Greenbrier River where the lime outcrops, a few miles southwest of Webster. These various favorable showings in surrounding territory, coupled with the fact that structural conditions in portions of the county are ideal, lead the writer to believe that the six negative tests already made should not finally condemn the 350,000 acres of Webster County, and that commercial deposits of oil and gas may yet be found within its limits. It is true that the search for these deposits will be hazardous from a financial standpoint and doubtless discouraging at first as it will probably be necessary to drill a sufficient number of preliminary tests throughout the county to furnish data for making a structure map on the Big Lime or Big Injun Sand, thus eliminating the convergence of the Pottsville and Mauch Chunk Series which causes the surface structure map to be somewhat misleading as to the exact pitch of the oil sands.

The wells that have been drilled range from a few hundred feet to 2500 feet, most of the customary producing sands of the State being penetrated by wells of the latter depth. No attempt has been made to reach the deep sands of Ohio which lie at a much lower level, being separated from the West Virginia and Pennsylvania sands by a shale interval of several thousand feet. Drilling is done altogether with cable

tools, the sandstone beds being too hard for the rotary method. Three strings of casing are generally used, 10-inch, 8¼-inch, and 6⅝-inch, the latter being set in the Big Lime. When water or caving shales are found below the Big Lime, it is necessary to set an additional string of 5 3-16-inch at some lower level.

The following classification of the various oil and gas sands of the State, taken with slight revisions from former Reports of the Survey[1], gives not only the sands that have produced shows of oil and gas in the immediate vicinity of Webster County but also the other known productive horizons of other counties and some that have produced oil in northwestern Pennsylvania and that have made shows of gas in some of the northern West Virginia Counties, as well as the deeper horizons of Ohio and Kentucky that are now being sought for at great expense in the northern part of the State:

Oil and Gas Horizons of West Virginia.

Pennsylvanian:	
Monongahela Series	Carroll Sand (Uniontown)
Conemaugh Series	Minshall Sand (Connellsville) Murphy Sand (Morgantown) Moundsville Sand (Saltsburg) First Cow Run (Little Dunkard) Sand (Buffalo) Big Dunkard Sand (Mahoning)
Allegheny Series	Burning Springs Sand (Upper Freeport) Gas Sand of Marion and Monongalia Counties (Lower Freeport)
Pottsville Series	Second Cow Run of Ohio (Homewood) Cairo Gas Sand Cairo Salt Sand Cairo? Rosedale Gas Sand Rosedale Salt Sand (Sharon Conglomerate)
Mississippian:	
Mauch Chunk Red Shale Series	Maxton, Dawson, Cairo Little Lime

[1]See Monongalia, Marion and Taylor Report, p. 388; Lewis and Gilmer Report, p. 176; and Barbour, Upshur and Western Portion of Randolph Report, p. 302.

Greenbrier Limestone	Big Lime
Pocono Sandstone Series	Keener Sand and Beckett Sand of Milton Big Injun Sand Squaw Sand Weir Sand Berea Sand
Devonian:	
Catskill Red Beds	Gantz Sand Fifty-foot Sand Thirty-foot Sand Gordon Stray Sand Gordon Sand Fourth Sand McDonald or Fifth Sand Bayard or Sixth Sand Elizabeth or Seventh Sand
Chemung and Portage Beds	Warren First Sand Warren Second (Burnside?) Sand Clarendon or Tiona Sand Speechley Sand Balltown or Cherry Grove Sand Sheffield or Cooper (Reiley?) Sand Benson, Bradford? or Deer Lick Sand Elk or Waugh and Porter Sand Kane Sand
Marcellus or Romney	Gas in Ohio and Kentucky
Corniferous Limestone	Ragland, Menefee or Irvine Sand of Kentucky
Oriskany Sandstone	Oriskany Sand
Silurian:	
Helderberg, Salina, and Niagara	"Big Lime" of Ohio (Newburg Sand near middle)
Medina White Sandstone	Clinton Sand of Ohio
Ordovician:	
Martinsburg or Cincinnati Shale	Hudson Sand Group of Kentucky
Trenton and other Limestones	Trenton Sand Group of northern Ohio

In Webster County the sands of the Monongahela Series do not exist at all, as they belong above the tops of the hills, and all the sands of the Conemaugh are absent except the Big Dunkard which is found only in a few hilltops along the northwestern edge. The sands of the Allegheny and upper portion of the Pottsville also are well up in the hills and are therefore not available as possible oil or gas horizons. The oil sand column of Webster may for that reason be considered

as starting with the Rosedale Gas and Salt Sands and extending down possibly to the Ordovician limestones which may be a potential source of oil and gas at some future date when methods for extremely deep drilling shall have been perfected. In the territory northwest of Webster the principal producing sands are the two lower horizons of the Pottsville and the sands of the Pocono and Catskill Series and it is these sands that apparently offer the most hope of oil and gas in Webster. There is little doubt that several of the deep sands of the Lower Devonian, Silurian, and Ordovician exist under the county but as most of them have not been pierced by the drill in any adjacent region little positive information is available on their possibilities for oil and gas.

In the following table the approximate intervals of the various sands from the four principal key-rocks; viz, Lower Kittanning Coal, Eagle Coal, Sewell Coal, and the top of the Big Lime, are given for several localities in the county, no sands being named in the list above the Rosedale Gas Sand, which, as explained above, is regarded as the highest possible producer. Regarding the accuracy of the table it can be stated that the intervals for the sands of the Pottsville, Mauch Chunk, Greenbrier, Pocono, and Catskill Series may be regarded as approximately correct for the northwestern half of the county. In the southeastern half much less information is available and the intervals are more in the nature of an estimate based on general geologic information of adjacent regions. The intervals to sands in the Chemung and Portage Beds may be regarded as semi-approximate since these groups have been drilled through in neighboring counties on the north. The intervals to the supposed sand horizons below the Chemung and Portage Beds are merely an estimate based on such general information as is available on these formations in the Appalachian region and this portion of the table will doubtless need extensive revision when wells have been drilled through these sands. In the region of Camden-on-Gauley it is very doubtful whether any sands of consequence can be found in the measures between the Berea and the Marcellus Group, as there is a wide area of southwestern West

Virginia, south of the Gauley and Great Kanawha Rivers, where this portion of the rock column is occupied largely by shale. For this reason these intermediate intervals are left blank in the Table. No intervals are given for the Keener Sand because in this region it is seldom found separate from the Big Injun:

Table of Oil and Gas Sand Intervals.

(Black-faced type indicates that the sand is above the key-rock named at the top of the column, and roman type indicates that it is below the key-rock).

Top of Sand.	Cleveland		Hacker Valley			Webster Springs		Camden-on-Gauley			Three Forks of Williams River	
	Lower Kittanning Coal.	Top of Big Lime.	Lower Kittanning Coal.	Eagle Coal.	Top of Big Lime.	Sewell Coal.	Top of Big Lime.	Eagle Coal.	Sewell Coal.	Top of Big Lime.	Sewell Coal.	Top of Big Lime.
Rosedale Gas	700	**725**	800	250	**950**	**100**	**1100**	700	**100**	**1300**	**100**	**1700**
Sewell Coal	.....	.....	.....	.....	.....	0	**1000**	800	0	**1200**	0	**1600**
Rosedale Salt	800	**625**	900	350	**850**	50	**950**	875	75	**1125**	75	**1525**
Maxton	1350	**75**	1575	1025	**175**	250	**750**	1050	250	**950**	275	**1325**
Little Lime	1400	**25**	1725	1175	**75**	900	**100**	1950	1150	**50**	1350	**250**
Big Lime	1425	0	1750	1200	0	1000	0	2000	1200	0	1600	0
Keener	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Big Injun	1600	175	1850	1300	100	1250	250	2300	1500	300	2100	500
Squaw	1750	325	2000	1450	250	1400	400	2600	1600	400	2300	700
Weir	1850	425	2100	1550	350	1500	500	2725	1925	725	2400	800
Berea	1950	525	2175	1625	425	1700	700	2800	2000	800	2500	900
Gantz	2000	575	2225	1675	475	1750	750	.....	.....	.....	2600	1000
Fifty-foot	2050	625	2275	1725	525	1800	800	.....	.....	.....	2700	1100
Thirty-foot	2100	675	2325	1775	575	1850	850	.....	.....	.....	2800	1200
Gordon Stray	2175	750	2400	1850	650	1925	925	.....	.....	.....	2900	1300
Gordon	2250	825	2475	1925	725	2000	1000	.....	.....	.....	3050	1450
Fourth	2325	900	2550	2000	800	2075	1075	.....	.....	.....	3125	1525
Fifth	2400	975	2625	2075	875	2150	1150	.....	.....	.....	3200	1600
Sixth	2475	1050	2700	2150	950	2250	1250	.....	.....	.....	3300	1700
Seventh	2575	1150	2800	2250	1050	2500	1500	.....	.....	.....	3750	2150
Warren First	2850	1225	3050	2550	1350	2800	1800	.....	.....	.....	4000	2400
Warren Second (Burnside?)	3100	1675	3300	2750	1550	3000	2000	.....	.....	.....	4150	2550
Clarendon	3300	1875	3500	2950	1750	3200	2200	.....	.....	.....	4300	2700
Speechley	3650	2225	3850	3300	2100	3550	2350	.....	.....	.....	4400	2800
Balltown	3800	2375	4000	3450	2250	3700	2700	.....	.....	.....	4700	3100
Sheffield (Reiley?)	4000	2575	4200	3650	2450	3900	2900	.....	.....	.....	4850	3250
Benson (Bradford?)	4300	2875	4500	3950	2750	4200	3200	.....	.....	.....	5100	3500
Elk	4500	3075	4700	4150	2950	4400	3400	.....	.....	.....	5250	3650
Kane	4700	3275	4900	4350	3150	4600	3600	.....	.....	.....	5400	3800
Marcellus Group	6800	5375	7000	6450	5250	6700	5700	7400	6600	5400	7500	5900
Corniferous Lime	7200	5775	7400	6850	5650	7100	6100	7600	6800	5600	8000	6400
Oriskany	7250	5825	7450	6900	5700	7150	6150	7650	6850	5650	8050	6450
Ohio "Big Lime"	7350	5925	7550	7000	5800	7250	6250	7700	6900	5700	8150	6550
Clinton	8400	6975	8600	8050	6850	8300	7300	8750	7950	6750	9200	7600
Martinsburg Group	8900	7475	9100	8550	7350	8800	7800	9250	8450	7250	9700	8100
Trenton Group	9800	8375	10000	9450	8250	9700	8700	10150	9350	8150	10600	9000

DESCRIPTION OF POSSIBLE PRODUCTIVE SANDS.

The sands of the Monongahela, Conemaugh, and Allegheny Series have proved to be productive mainly in the western portion of the State where they dip to a low structural level, being covered by the Permo-Carboniferous deposits of the Dunkard Series. In Webster they either belong above the tops of the mountains or lie well above the erosion level of the streams and thus offer no hope of oil or gas. Their description is accordingly omitted from this Report.

SANDS OF THE POTTSVILLE SERIES.

As previously stated the sands in the upper portion of the Pottsville Series lie mainly above drainage in Webster and offer little, if any, hope of oil or gas production in the county, and for that reason need no description in this volume.

Rosedale Gas Sand. — The Rosedale Gas Sand of the writer[2], named from its occurrence in the vicinity of Rosedale, Braxton County, where it is a well-defined gas producer, and probably correlating with either the Guyandot or Lower Guyandot Sandstone of the New River Group, should be present below drainage over a considerable region in the northern portion of Hacker Valley District, in western Holly, and the northern portion of Glade, its interval below the Lower Kittanning Coal being about 700 feet. Inasmuch as this sand is apparently one of the horizons that made encouraging shows of oil and gas in the Panhandles of Lewis and Upshur Counties, it is possible that some production might be found in it in certain portions of Webster as outlined above. Its thickness varies from 40 to 60 feet and it is usually gray and coarse, often containing copious amounts of salt water.

Rosedale Salt Sand. — The Rosedale Salt Sand of the writer[3], named from its occurrence along the Braxton-Gilmer County Line in the vicinity of Rosedale where it has produced

[2]D. B. Reger, Lewis and Gilmer Report, W. Va. Geol. Survey, p. 178; 1916.

[3]Ibid., p. 178.

a considerable amount of oil and some gas, and apparently correlating with the Upper Raleigh (Sharon) Sandstone of the New River Group, should be present below drainage in Webster in practically the same region as outlined for the Rosedale Gas Sand, its interval below the Lower Kittanning Coal being approximately 800 feet. This sand made numerous good shows of oil and gas in the Panhandles of Lewis and Upshur, next to the Webster line, where it appeared to be largely saturated with salt water. It is possible that in the higher structural level of northwestern Webster oil or gas might be found in it free from water. Its thickness varies from 50 to 100 feet and it is gray and coarse, being frequently pebbly, its physical character making it an ideal oil reservoir.

SANDS OF THE MAUCH CHUNK SERIES.

Maxton Sand. — The Maxton Sand, occurring in the Mauch Chunk at a variable interval below the top of the Series but believed by Hennen[4] to correlate with the Princeton Conglomerate, is a horizon that has produced a large amount of oil and gas in some of the western counties of the State where it is usually noted as a fine-grained, greenish stratum, being somewhat lenticular in its occurrence. Little is known of its character in the northwestern portion of Webster where it lies under drainage and where it is a potential source of oil and gas, but in the southeastern part of the county where the rise of the rocks brings it above drainage, the Princeton Conglomerate is a very massive and conglomeratic horizon, physically capable of holding enormous quantities of oil. If it be true that the two titles refer to the same horizon, it is most probable that its character changes greatly soon after it disappears under drainage in going westward as the well records do not describe it as being pebbly. In northwestern Webster its position is probably from 1300 to 1500 feet below the Lower Kittanning Coal and its probable thickness 30 to 50 feet.

Little Lime. — The Little Lime is a calcareous stratum

[4]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Survey, pp. 249-250; 1915.

that, according to many well records in the western portion of the State, comes only a few feet above the Greenbrier Limestone, or "Big Lime," being separated from the same by a few feet of shale known as the "Pencil Cave". It seems likely, as previously noted, page 226, that this member correlates with the Hinton Limestone. It exhibits shows of oil or gas in only a few localities and is of interest principally as a marker for the Big Lime below it, its thickness being 10 to 50 feet.

SANDS OF THE GREENBRIER LIMESTONE SERIES.

Big Lime. — The Big Lime, or Greenbrier Limestone, belonging 1200 feet below the Eagle Coal in the region of Hacker Valley, 1000 feet below the Sewell at Webster Springs and approximately 1400 feet below the same horizon at the extreme southern end of Webster, is a hard, gray, calcareous stratum, varying from about 50 feet in thickness at the northern point of the county to 500 feet or more along the Pocahontas and Greenbrier lines. In the central and northern portion of the State it is usually barren of oil and gas although shows are sometimes found in it. In the southwestern portion of the State, it has produced a large amount of gas and a little oil in Logan, Mingo, Wayne, and other counties. In Webster it belongs below drainage everywhere except along portions of the deep Elk River Valley above Webster Springs. In the Greenbrier Valley, south of Webster, seepages have been reported from it and it may contain small deposits of oil or gas within the county although it is most probable that this is not the case since it is not known to be either dolomitic or arenaceous, one of these conditions being regarded as a prime essential for oil or gas in a limestone stratum. Some geologists have held that the oil and gas content of the Big Injun Sand has migrated downward from the Big Lime, and if that could be true, its presence over almost the entire acreage of Webster is a factor of no small importance. In addition to its value as a possible genesis of oil and gas it forms a well-defined and unmistakable key-rock at the top of the main oil sands that gives it a definite stratigraphic value in the rock column.

PLATE XVI.—Johns Cut along West Virginia Midland Railroad, showing soft Eagle? Shale.

SANDS OF THE POCONO SANDSTONE SERIES.

Keener Sand. — The Keener Sand, coming at the top of the Pocono, and directly underlying the Big Lime, is usually regarded as split off the Big Injun Sand, being only 25 to 30 feet when distinguished from the latter sand. So far as known it does not occur as a distinct stratum in Webster or in its immediate vicinity, its identity being merged with that of the Big Injun.

Big Injun Sand. — The Big Injun Sand, usually directly underlying the Big Lime but sometimes separated from it by the thin Keener Sand and often a streak of red shale, in the southern portion of the State, is probably the most valuable oil and gas sand in the State. It varies from 50 to 200 feet in thickness and is usually a coarse, pebbly stratum, with an ideal physical structure for holding oil and gas. In the vicinity of Craddock, Upshur County, it has produced a considerable amount of gas, this point being only three or four miles northeast of the Webster line. Such wells as have been drilled through it in northern Webster have apparently found no oil or gas therein, salt water having been found at the village of Cleveland. Since the presence of salt water in this stratum is common in the synclines of the western portion of the State and locations made farther up the structural slope often find oil or gas, the show of water at Cleveland is not unfavorable.

Squaw Sand. — The Squaw Sand, usually found about 150 feet below the top of the Big Injun, and being about 1750 feet below the Lower Kittanning Coal in the vicinity of Cleveland, has an average thickness of 25 to 50 feet. In the region adjacent to Webster it is not generally productive but in Kanawha County it is a prolific oil and gas sand. Its color is gray and its texture medium-coarse.

Weir Sand. — The Weir Sand of Krebs[5], named from its occurrence in the Blue Creek Oil Field of Kanawha County, where it is a prolific oil producer, being regarded by some geologists as identical with the Squaw Sand, belongs in the

[5]C. E. Krebs, Kanawha Report, W. Va. Geol. Survey, pp. 302-303; 1914.

Cleveland region about 425 feet below the top of the Big Lime and 1850 feet below the Lower Kittanning Coal. It is usually not more than 25 to 50 feet in thickness and is sometimes absent entirely, its color when present being gray and its texture medium-coarse. It has not been productive in the region adjoining Webster.

Berea Sand. — The Berea Sand, belonging at the base of the Pocono and about 525 feet below the top of the Big Lime in the northern part of the county, is one of the most persistent and valuable of the oil and gas horizons of the State, its production in recent years in the Cabin Creek, Kanawha County, and other fields having given it an additional interest in counties which, like Webster, lie along much the same belt with reference to the Appalachian Basin. This sand varies from 10 to 40 feet in thickness and is usually marked by a stratum of brown, coffee-colored shale that comes just above it and aids in its identification. Its color is gray and its texture coarse and sometimes pebbly. In Upshur and other neighboring counties it has exhibited some encouraging shows of oil.

SANDS OF THE CATSKILL RED BEDS.

The sands of the Catskill Series are distinguished generally by frequent beds of red shale between the various sandy members and by a brownish-red color of the sands themselves. Most of them are lenticular, often thinning out completely in a distance of a few hundred feet. There are usually 8 to 10 different sands in the entire series, varying from 10 to 40 feet in thickness, and as they are all of the same physical appearance and texture it is often difficult to identify the different members with certainty in regions where a large number of well records are not available. A feature of prime importance is that these sands are nearly always non-water-bearing in the Appalachian Basin, thus permitting the oil to accumulate along the axes of the synclines instead of farther up the slopes as is often the case with the higher sands. In Webster there is no certainty that these sands exist in the southwestern portion of the county as this region seems to be with-

in the area where this group of rocks is much thinner than usual and most of the sands have disappeared. In eastern and southern Webster, however, the Catskill sands should be present since this is in the direction of the thickening of the Series, and they are noted in well records east of the county as also at their outcrop in the Greenbrier Valley.

Gantz Sand. — The Gantz Sand, coming near the top of the Catskill and separated from the Berea Sand by only a few feet of red or brown shale, is frequently absent in the region immediately north of Webster. When present its thickness varies from 5 to 25 feet and its interval below the top of the Big Lime in the region of Hacker Valley should be about 475 feet. In one of the wells near Craddock, Upshur County, it made a showing of oil.

Fifty-foot Sand. — The Fifty-foot Sand, coming next below the Gantz, should be about 525 feet below the top of the Big Lime in the Hacker Valley region, and as it is among the more persistent of the Catskill sands, its thickness varying from 10 to 50 feet, it should be present over a considerable portion of northern and eastern Webster.

Thirty-foot Sand. — The Thirty-foot Sand, similar to the Fifty-foot, with which it often merges into one unbroken stratum, belongs about 575 feet below the top of the Big Lime in the Hacker Valley region, its thickness probably being 10 to 30 feet. In the Stonecoal Gas Field, in Upshur County, ten miles north of the Webster line, it is one of the gas-producing horizons, and it exhibited a show of gas in the J. W. Lake No. 1 Well just northwest of Cleveland.

Gordon Stray Sand. —The Gordon Stray Sand, belonging about 650 feet below the top of the Big Lime in northern Webster, and probably being 10 to 25 feet in thickness, is one of the more lenticular members of the Catskill, but in the northwestern portion of the State has produced a large amount of oil and gas. So far as known it is not present or productive in the immediate vicinity of Webster County.

Gordon Sand. — The Gordon Sand, which together with the Berea ranks next after the Big Injun in the amount of oil and gas it has produced in the State, belongs about 725 feet

below the top of the Big Lime in northern Webster, its thickness probably varying from 5 to 30 feet. In Upshur County it is one of the producing gas horizons of the Stonecoal and Frenchton Fields.

Fourth Sand. — The Fourth Sand, coming next below the Gordon, is approximately 800 feet below the top of the Big Lime in northern Webster, being from 10 to 30 feet in thickness. In Upshur this stratum has produced gas in the Frenchton and Stonecoal Fields and in Braxton it has made a show in a well northeast of Sutton.

McDonald or Fifth Sand. — The McDonald or Fifth Sand, which is one of the great gas-producing horizons of Lewis and Harrison Counties, belongs approximately 875 feet below the top of the Big Lime and 150 to 175 feet below the Gordon in northern Webster, its thickness being 10 to 40 feet. In Upshur it made shows of gas in one or two wells and in Braxton has made shows of both gas and oil in a few wells not far from the Webster line.

Bayard or Sixth Sand. — The Bayard or Sixth Sand comes next below the Fifth and in northern Webster should belong about 950 feet below the top of the Big Lime and 200 to 225 feet below the top of the Gordon Sand, being somewhat lenticular, its thickness varying from 5 to 20 feet. In the **Sherman Heirs No. 2 (5) Well,** near Craddock, Upshur County, it made a show of gas.

Elizabeth or Seventh Sand. — The Elizabeth or Seventh Sand, coming at the base of the Catskill and often being absent from the measures, belongs about 1050 feet below the top of the Big Lime in northern Webster, having a probable thickness of 5 to 25 feet when present. In the **C. P. Dorr No. 1 (17) Well** at Webster Springs, a pocket of gas was found in a sand coming 1491 feet below the top of the Big Lime that has been doubtfully correlated with the Elizabeth, but may represent the Warren First of the Chemung Series.

SANDS OF THE CHEMUNG AND PORTAGE BEDS.

Little definite knowledge is available regarding the sands of the Chemung and Portage Beds in Webster, these measures

having been penetrated only to a depth of 473 feet in the well at Webster Springs (No. 17 on Map II) where no sands were found. In Upshur, Barbour, and Taylor Counties, which occupy successive areas north of Webster, recent drilling has disclosed several of these deep sands and one or two of them have produced gas in commercial quantity and some of them have made slight shows of oil. In the **Mayton Lumber Company No. 4903 (13) Well,** located in Randolph County at Arvondale Junction just northeast of the Webster line, a show of oil was found in what appears to be the Speechley Sand, and in Upshur County the same sand made a show of gas in the **Isherwood and Cody No. 1 Well** at Stockerts, Washington District. At Buckhannon, Upshur County, the **F. & O. Leonard No. 7151** made a show of gas in what may be the Balltown Sand. In Barbour County gas production has been developed in the Benson Sand of I. C. White and the writer[6], that may correlate with the Bradford or possibly the Kane Sand of northern Pennsylvania. Sufficient information is not available to describe in detail the various sands of these two groups but it seems fairly certain that several of them exist under portions of Webster and their succession and probable intervals below the Big Lime and other formations are given in the list of oil and gas horizons, page 234, and in the table of oil and gas sand intervals, page 237.

SANDS OF THE LOWER DEVONIAN.

The determined efforts of some of the larger operators in the State to test the deep sands of the Lower Devonian, Silurian, and Ordovician Rocks make a discussion of their character and depth a pertinent matter even though the information concerning them is vague and uncertain. The goal of most of these efforts has been the Clinton Sand of Ohio but as yet it has never been penetrated at any point in the defined oil and gas fields of the State. That some of these deep sands which produce great quantities of oil and gas in Ohio, Indiana, Kentucky, and New York probably exist in

[6]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, p. 310; 1918; I. C. White, Introduction to same Report, p. xlv.

good development along the Appalachian Basin in West Virginia seems evident not only from the fact that they have produced oil and gas in the neighboring States named above but also from the additional knowledge that they outcrop in the Alleghany Mountains immediately east of the West Virginia fields. Should commercial production of gas be developed in these lower sands, rock pressures would be enormous, making it possible to transport the gas for long distances without artificial compression.

Marcellus or Romney Shale Group. — Beneath the Chemung and Portage Beds come the Genesee and Hamilton Shales with a probable thickness of 1200 to 1500 feet, not known to contain productive horizons in any neighboring locality, but in the Marcellus Group, coming below the two formations named above, gas has been found in lenticular sands in Ohio and Kentucky. This group is probably 300 to 400 feet thick, the shales being dark-brown or black in color. The probable depth to the top of the group at various points in Webster is given in the Table of Oil and Gas Sand Intervals, page 237.

Corniferous Limestone. — The Corniferous Limestone, so named because of the flint or hornstone that it sometimes contains, is a dark, hard, calcareous stratum, often containing nodules of flint or other siliceous matter, and varying in thickness from 10 to 50 feet, its position being immediately beneath the black Marcellus or Romney Shale. In Kentucky this member of the Devonian has produced a large amount of oil and gas, being known in various regions of that commonwealth as the "Ragland", "Menefee", or "Irvine" Sand. Owing to its great depth this stratum has been penetrated in West Virginia by only six wells of which records are available; viz, the Central City Well in Cabell County, the David Bartram No. 483 Well in Wayne County, the Slaughter Creek Coal and Lumber Company Well in Kanawha County, the Martha O. Goff No. 4190 in Harrison County, the Parsons Pulp & Lumber Company Well in Tucker County, and the Volcanic Oil and Coal Company No. 4670 Well in Wood County. It has not proved to be productive except in the last-named

well, where, according to Dr. I. C. White[7] it is apparently the Corniferous Limestone that has produced some oil and gas, a much greater production of gas being obtained in the Oriskany Sand just below it.

In Pocahontas County, southeast of Webster, the writer has observed what appears to be the Corniferous Limestone in the region southeast of the Greenbrier River where it is brought to the surface by steep mountain folds, being dark, hard, and flinty, and holding some small species of marine fossils, no corals being in evidence. These exposures in a region not far from Webster would indicate its presence in that county, where, if not actually impregnated with oil or gas, it would serve as a definite marker for the Oriskany, Clinton, and other sands below it. As named in the Table of Oil and Gas Sand Intervals, page 237, its interval below the top of the Big Lime at Webster Springs is estimated at 6100 feet, which would represent its depth below surface as the top of the Big Lime crops just above the water-level at that point.

Oriskany Sand. — The Oriskany Sand, coming just beneath the Corniferous Limestone, is a grayish-white or yellowish-colored sandstone, 25 to 100 feet in thickness and coarse in texture, being listed as a producer of oil and gas in southern Indiana, southern Ontario, and central New York. In West Virginia it has been pierced by the wells named above for the Corniferous Limestone, with the exception of the Central City well which stopped in the lime, and the Martha O. Goff Well in Harrison County which is still drilling in the lime. In most of these wells it has been barren and in some it has produced salt water but in the well recently drilled on the Volcanic Oil and Coal Company property in Wood County it has produced gas with a considerable volume at first, but subsequently drowned out with salt water from the same horizon. South of Webster County its presence has been noted in the mountain region of Pocahontas County named above under the discussion of the Corniferous Limestone, and it therefore seems quite certain that it underlies a

[7] I. C. White, Introduction to Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey; p. lii; 1918.

considerable portion of Webster. Owing to its nature as a water-bearing stratum any tests made into it should be located on anticlinal domes if possible. Its depth below the top of the Big Lime and below surface at Webster Springs is estimated at 6150 feet.

SANDS OF THE SILURIAN.

The Silurian Rocks having a probable thickness of 1200 to 1500 feet in Webster County, contain some massive limestones, several thick beds of shale, and a sandy member that has produced a large amount of oil and gas in adjacent States where it has been possible to reach it with the drill, besides other sands that have not been so prolific in hydrocarbon substances.

Helderberg, Salina and Niagara Limestones. — The Helderberg Limestone, coming partly in the Devonian and partly in the top of the Silurian and usually consisting of massive white or gray limestone beds interstratified with thin shale breaks, followed by the Salina Beds immediately below it, the same being an interstratification of lime, shale, and rock salt, followed at the base by the Niagara Limestone, similar in character to the Helderberg, comprise what is collectively termed in the southeastern Ohio oil fields the "Big Lime". This group, which should not be confused with the Big Lime of West Virginia, lying several thousand feet above it, has produced oil and gas in Ohio and New York and in Ontario. In West Virginia it has been penetrated only in the Bartram deep well in Wayne County and in the Slaughter Creek Coal and Lumber Company Well in Kanawha County, in neither of which it showed oil or gas but contained salt water in the latter hole. As an oil and gas reservoir in West Virginia it should not be regarded as a hopeful horizon. The Newburg Sand of the Cleveland, Ohio, region belongs near the center of this "Big Lime" series. At Webster Springs its depth below surface is estimated as about 6250 feet and its probable thickness 800 to 1000 feet.

Clinton Sand. — The Clinton Sand of Ohio, generally conceded to be the Medina White Sandstone, coming at the top

of the Medina Group of shales and sandstones, is an arenaceous stratum varying from 25 to 100 feet in thickness. In southeastern Ohio where it has produced a large amount of oil and gas, it comes only 100 to 160 feet below the base of the Ohio Big Lime. The Clinton Shales in central West Virginia are probably thicker than in the Ohio Clinton oil and gas fields as there is known to be a general eastward thickening of the Devonian and Silurian shales toward the Alleghany Mountains where they have been observed at outcrop along the eastern rim of the Appalachian Basin. In West Virginia the Clinton Sand has not been penetrated by the drill and its value as an oil and gas horizon is still a matter of conjecture but its abundantly petroliferous character in neighboring States makes it a possible source of oil and gas. At Webster Springs it is estimated to be about 7300 feet underground.

SANDS OF THE ORDOVICIAN.

Certain horizons of the Ordovician Period have produced oil and gas in neighboring States and the catalog of possible deep sands is not complete without reference to them.

Martinsburg or Cincinnati Shale. — The Martinsburg or Cincinnati Group, coming at the top of the Ordovician and at a supposed interval of about 500 feet below the top of the Clinton Sand, and composed mainly of gray shales with sandstone lentils, has produced a considerable amount of gas in central Kentucky, the production being in the several lenticular sands. The thickness of the group is probably 500 feet or possibly more and at Webster Springs its top is estimated to be 7800 feet below drainage.

Trenton Limestone Group. — The Trenton Limestone Group, composed mainly of the Trenton and other massive limestones and having an estimated thickness of 1200 feet or more in central West Virginia, is the productive group in north central Ohio where it has been especially prolific in gas. Certain members of the same group have also produced oil and gas in Indiana, Kentucky, and New York, and it therefore seems probable that the pay formation might extend un-

der central West Virginia, the presence of these limestones in good development at their outcrop in the Alleghany Mountain region east of the Appalachian Basin tending to confirm their presence under the Basin itself. This group is separated from the Martinsburg or Cincinnati Shale Group by the Utica Shales, black in color and containing sandstone lentils, their thickness being estimated at 300 feet or more. At Webster Springs the depth of the top of the Trenton Limestone Group below drainage is estimated at 8700 feet.

WELL RECORDS AND PROSPECTIVE AREAS.

EARLY HISTORY.

The first attempt at drilling for mineral matter in Webster was the **John T. McGraw Salt Sulphur Well (19)** at Webster Springs, put down by Addison McLaughlin, who then owned the land, between 1850 and 1860, the exact date not being available. This well was evidently drilled in the hope of obtaining salt brine, much sought after for salt making before railroad transportation was developed. The well was drilled to a total depth of 169 feet, obtaining sulphur water at a shallow depth and salt water at the bottom of the hole. One of the earliest attempts to find oil and gas was the **J. N. Camden No. 1 (20) Well,** drilled by the owner on his property at Camden-on-Gauley, soon after the railroad was completed during the years 1891 and 1892. This well had a total depth of 2501 feet but failed to find oil or gas. Near the same time or subsequently two wells were drilled in the vicinity of Cleveland, one of these being the **Vandervort & Pickens No. 1 (2) Well,** drilled by the Haddix and Leading Creek Oil and Gas Company, its total depth being 1801 feet and the result much the same as at the Camden Well. The other was the **William Mullins No. 1 (1) Well,** drilled by Story and O'Hara on Threelick Run, the same being a shallow well that found a show of gas but was abandoned. The **A. W. Anderson No. 1 (3) Well** was drilled at a later date in the vicinity of Hacker Valley, but this well found only a show of gas and was abandoned. The **C. P. Dorr No. 1 (17) Well,** drilled at Webster

Springs, reached a total depth of 2085 feet but made only a show of gas. The most recent well in the county was the **Floyd Morton No. 1 (21) Well,** drilled on Strouds Creek near Tioga, but this hole stopped just below the Big Lime without penetrating the Big Injun and Berea horizons.

SUMMARIZED WELL RECORDS.

The following table, compiled from the detailed records in Webster and territory immediately adjoining, is intended to exhibit at a glance the most important data regarding these wells, giving not only the serial numbers by which their positions are fixed on Map II, but also the tidal elevations, depth to Sewell Coal when available, depth to the principal sands, total depth, and the record of producing sands. The detailed records of such as are available are published on subsequent pages and the index should be consulted to find the record of any particular well desired. The detailed records of a few wells could not be secured and for these the table gives all available information. Throughout the text all wells when mentioned are accompanied by the serial numbers in parentheses, so that their positions on Map II may be readily found. In the elevation column, the letter "B" indicates an elevation secured by aneroid barometer checked on near-by spirit-levels, and the letter "L" indicates a hand-level determination from a neighboring bench mark. All depths are expressed in feet. The following abbreviations of company names have been used in the table:

Baker Run	Baker Run Oil and Gas Company
Buckhannon Chem	Buckhannon Chemical Company
Greater Pb. O. & G	Greater Pittsburgh Oil and Gas Company
Haddix	Haddix and Leading Creek Oil and Gas Company
Hope	Hope Natural Gas Company
Nicholas O. & G	Nicholas Oil and Gas Company
Poca. Co. C. & L	Pocahontas County Coal and Land Company
Price et al	R. E. Price and Others
Stewart O. & G	Stewart Oil and Gas Company
W. S. H. & L	Webster Springs Heat and Light Company

Under the producing-sand column all shows of oil and gas are noted, the following abbreviations being used for the various sands:

Rd. Salt	Rosedale Salt
B. Lm	Big Lime
B. I	Big Injun
50-ft.	Fifty-foot
30-ft.	Thirty-foot
Stray	Gordon Stray
Gord.	Gordon
4th	Fourth
5th	Fifth or McDonald
6th	Sixth or Bayard
7th	Seventh or Elizabeth

Summarized Record of Tests for Oil and Gas in Webster County.

No. on Map II.	Name of Property.	Magisterial District.	Company.	Elevation above Tide. Feet.	Sewell Coal. Depth top.	Sewell Coal. Thickness Feet.	Big Lime Top.	Big Injun Sand Top.	Berea Sand Top.	Gordon Sand Top.	Fifth Sand Top.	Total Depth.	Producing Sand and Remarks	No on Map II.
1	Wm. Mullins No. 1	Hacker Valley	Story & O'Hara	1205B								500?	Gas show	1
2	Vandervort & Pickens No. 1	Hacker Valley	Haddix	1220B			1285	1500				1807	Gas show?	2
3	A. W. Anderson No. 1	Hacker Valley	Price et al	1465B								1750+	Gas show	3
4	Edward H. Peck No. 1	Banks (Upshur)	Buckhannon Chem.	2230B			1240	1295	1565			1766	Berea, gas show	4
5	Sherman Heirs No. 2	Banks (Upshur)	Greater Pb. O. & G.	2355B			1230	1305	1526	1925	2072	3270	Berea. 6th, gas show; Salt, Squaw oil	5
6	Silica Sand Co. No. 3	Banks (Upshur)	Greater Pb. O. & G.	2505B			1490	1500	1787				Maxton, oil; B. I. gas	6
7	Butts-McCormick-Wilson No. 1	Banks (Upshur)	Greater Pb. O. & G.	2310B				1300	1589	2010	2200	2252	Dry hole	7
8	Silica Sand Co. No. 1	Banks (Upshur)	Greater Pb. O. & G.	2050B				1225	1325			1366	B. I. gas	8
9	Silica Sand Co. No. 2	Banks (Upshur)	Greater Pb. O. & G.	2035B				945	1309			1418	B. I. gas	9
10	Sherman Heirs No. 1	Banks (Upshur)	Greater Pb. O. & G.	2025B			1065	1300				1584	B. I. gas	10
11	Silica Sand Co. No. 4	Banks (Upshur)	Greater Pb. O. & G.	2505B			1566	1786				1820	Salt, Maxton, B. I. gas show; Salt, Maxton, oil show	11
12	Buckhannon Chem. Co. No. 1	Middle Fork (Randolph)	Buckhannon Chem.	1905L			835	880				1481	Dry hole	12
13	Mayton Lumber Co. No. 4903	Middle Fork (Randolph)	Hope	2265B			1281	1341			2155	4949	Speechley, oil show	13
14	A. M. Berry Heirs No. 2475	Holly (Braxton)	Hope	1025B			1195	1240		1817	2008	2383	5th, gas and oil shows	14
15	Hanson C. Cogar No. 1	Holly (Braxton)	Baker Run	930B								2900?	Dry	15
16	Centralia Imp. Co. No. 1	Holly (Braxton)	Stewart O. & G.	953L	312	5	960	1060	1425	1680	1850	3018	Rd. Salt, B. I., oil shows	16
17	C. P. Dorr No. 1	Fork Lick	W. S. H. & L.	1430B			109	363	780	1053	1205	2085	Gas show	17
18	Wm. Smith Salt Well	Fork Lick	Wm. Smith	1435B									B. Lm., salt water	18
19	J. T. McGraw Sulphur Well	Fork Lick	J. T. McGraw	1440B								169	B. Lm. sulphur water	19
20	J. N. Camden No. 1	Glade	J. N. Camden	2020L	458	1	1648	1950				2501	Dry	20
21	Floyd Morton No. 1	Glade	R. V. Dennison et al.	2070B	580	2	1773					2170	Dry	21
22	John N. Dodrill No. 1	Hamilton (Nicholas)	Nicholas O. & G.	1130L								2700?	B. I.? gas show	22
23	John N. Dodrill Sulphur Well	Hamilton (Nicholas)	A. McLaughlin	1130L								750?	Gas show; salt sulphur water	23
24	Pocahontas Co. Coal & Land Co. No. 1	Edray (Pocahontas)	Poca. Co. C. & L.	3390B			607	1317	1781	2336	2457	3032	B. I., slight show of oil	24

In addition to the abbreviated records of the table, such detailed logs as are available will be given in the following pages, except such as have been incorporated in the sections of Chapter IV and can be referred to there. Reference to these will be made in their proper serial sequence. These records show, as far as could be obtained, all sands and formations encountered, as well as coal seams, water horizons, casing records, and shows of gas or oil. The records of a few important tests could not be obtained. In all cases an attempt has been made to give the proper correlation of the various sands and coals, the comparative information at hand being much more complete than could be had by the drillers.

DETAILED WELL RECORDS AND PROSPECTIVE AREAS, HACKER VALLEY DISTRICT.

Hacker Valley District lies in the northern portion of the county, next to Upshur and Lewis. Its rock structure is mainly that of a long even monocline, rising steadily toward the southeast, and being broken by only a few slight terraces, except at the southern edge of the district where the Webster Springs Anticline and the Kovan Syncline have their northern termini, and afford a slight variation from the general condition. Three wells have been drilled within the district, of which two are reported to have made shows of gas and the third was a dry hole.

The **William Mullins No. 1 (1) Well**, located on Threelick Run of Little Kanawha River, 0.9 mile southwest of Bois, was drilled by Story and O'Hara, starting about 325 feet below the Lower Kittanning Coal, its tidal elevation being 1205' B. The detailed log of this well could not be obtained, but according to local report it was drilled more than 500 feet deep and made a show of gas. At the depth named above the hole should have penetrated both the Rosedale Gas and Rosedale Salt Sands and it is probably in one of these members that the pay was found, as these sands were producing horizons in the vicinity of Bablin, Lewis County, two or three miles northeast of the Mullins Well.

The **Vandervort and Pickens No. 1 (2) Well**, the detailed

record of which is published in connection with the section for Cleveland, pages 69-70, is located at the mouth of Jerry Run of Little Kanawha River, 1 mile southwest of Cleveland, its elevation being 1220' B. The hole starts approximately 460 feet below the Lower Kittanning Coal and was drilled to a depth of 1807 feet, having made a show of gas according to local report, the well log failing to record the same. The Rosedale Gas and Rosedale Salt Sands, in which production might have been expected, were not found, their horizons being occupied by shale, which had evidently replaced them locally. The Big Injun Sand produced salt water, but the Berea, which was 50 feet thick, made no show of anything. No sands were found below the Berea, the bottom of the well being about the horizon of the Gordon Sand.

In the southern Panhandles of Lewis and Upshur Counties, just north of the Webster line and 2 to 3 miles northwest of Cleveland, several wells have been drilled for oil, most of them having been shallow tests. As previously stated in various publications of the Survey[8] where these wells have been listed and such records published as could be secured, most of these wells made shows of oil or gas in the Rosedale Gas or Rosedale Salt Sands, but on account of copious flows of salt water little attempt was made to recover the oil. One of them made some gas from the Thirty-foot Sand and another made a show of oil in the Gordon.

The **A. W. Anderson No. 1 (3) Well,** located on Left Fork of Holly River, 0.9 mile west of Hacker Valley, was drilled in 1912 by R. E. Price, of Fairview, W. Va., and associates. According to local report the drilling contract called for a depth of 1750 feet and this figure was slightly exceeded in the actual drilling, two or three pockets of gas large enough to make it temporarily unsafe to keep fire under the boiler having been found during the progress of the work. The well starts approximately at the level of the Eagle Coal and a

[8] I. C. White, Vol. I(a), p. 375; 1904; D. B. Reger, Lewis and Gilmer Report, pp. 431-432; 1916; Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 309-310; 1917; and Barbour, Upshur and Western Portion of Randolph Report, pp. 375-376; 1918.

depth of 1750 feet should have pierced the horizon of the Fifty-foot Sand.

The **Craddock Gas Field**, located in the vicinity of Craddock, along the Buckhannon River, Upshur County, 2½ miles north of the northeast corner of Webster, contains eight wells, four of which were classed as dry holes, one made a fair showing of oil, and the other three produced gas commercially, mostly from the Big Injun Sand. The abbreviated logs of these holes (Nos. 4 to 11, inclusive) have been given in the Summarized Record of Tests for Oil and Gas, page 253, and their records have been published in detail in a previous volume of the Survey[9].

The **Mayton Lumber Company No. 4903 (13) Well**, located at Arvondale Junction, Randolph County, on the Buckhannon River, 0.9 mile east of the common corner of that county with Webster and Upshur, and drilled by the Hope Natural Gas Company, was a deep test, completed in 1917. According to D. D. Teets, Jr., the hole starts at an elevation of 2265′ B., probably a few feet above the level of the Eagle Coal which appears to be cut out by a heavy sandstone recorded at the top of the hole. The record of this well has been published in detail in connection with the section for Arvondale Junction, pages 71-72. Some oil is found in a gray sand at 3393 feet that probably represents the Speechley, and the hole was drilled to a total depth of 4949 feet, and then plugged and abandoned.

Prospective Oil and Gas Areas, Hacker Valley District. — The tests already made in Hacker Valley District have been discouraging but are by no means conclusive that commercial quantities of oil and gas do not exist. Recognizing fully the fact that the territory must be regarded as hazardous the following localities are suggested for further drilling: (1). The extreme northwestern corner of the district, between Wildcat and the 1000-foot green structure contour shown on Map II, offers some hope of oil and gas in the Rosedale Gas and Rosedale Salt Sands. (2). The showing of salt water found in

[9]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, pp. 376-383; 1918.

PLATE XVII.—View from West Virginia Midland Railroad from point south of Elk-Holly summit, looking westward toward 'Puzzle Hole" of Elk River; Topography of Allegheny and Pottsville Series.

the Big Injun Sand in the **Vandervort & Pickens No. 1 (2) Well,** indicating a medium sufficiently porous to contain oil or gas, makes it seem probable that a location farther up the structural slope of the rocks might find something. A favorable location would be at or just above the forks of Buffalo Run, one mile southeast of Cleveland, where there is an abrupt change to a steeper slope. (3). The gas found in the Big Injun Sand at Craddock, would indicate a possible southwestward extension of the pay belt into Webster. A favorable location would be on Laurel Fork of Left Fork of Holly, between Birchpen Run and the three forks of Laurel, as the rocks have a terrace structure in this locality. (4). The cove-like structure in the vicinity of the Potato Knob, on Left Fork of Holly River at the mouth of Fall Run indicates a possible pool of oil or gas. (5). The structural dome one mile south of Hodam at the northern end of the Webster Springs Anticline would be a favorable locality to drill for gas.

DETAILED WELL RECORDS AND PROSPECTIVE AREAS, HOLLY DISTRICT.

Holly District, comprising a wide belt of country extending in an east and west direction entirely across the county north of its center has had no tests of any character for oil and gas. Besides the wells drilled in adjoining districts of Webster, three tests have been made in Holly District, Braxton County, a short distance west of the Webster line.

The following well gave a smell of oil and gas in the Fifth Sand, its complete record, as previously published by the Survey[10], reading as follows:

[10]Ray V. Hennen, Braxton and Clay Report, W. Va. Geol. Survey, pp. 342-343; 1917.

A. M. Berry Heirs No. 2475 Well Record (14).

Holly District, Braxton, on Kanawha Run of Holly River, 0.8 mile north of Holly Station; authority, Hope Natural Gas Company; completed, May 14, 1912; elevation, 1025′ B.

	Top Feet	Bottom Feet
Sand, Rosedale Gas	390	437
Coal, Sewell?	562	568
Sand, Rosedale Salt	632	662
Sand, Rosedale Salt	755	780
Unrecorded (water at 788′)	780	823
Sand, Second Salt	823	915
Sand, Maxton	1040	1125
Little Lime	1180	1195
Big Lime	1195	1240
Sand, Big Injun	1240	1346
No Fifty-foot, Thirty-foot, or Gordon Stray Sands	.....	.....
Sand, Gordon	1817	1842
No Fourth Sand	.....	.....
Sand, Fifth (smell of oil and gas at 2008′)	2008	2012
Unrecorded	2012	2383

10″ casing, 215′; 8¼″ casing, 762½; 6⅝″ casing, 1255′.

The **Hanson C. Cogar No. 1 (15) Well,** drilled by the Baker Run Oil and Gas Company, and located in Holly District, Braxton, on Elk River, 0.5 mile north of Baker Run Station, starts 440 feet below the Upper Kittanning Coal, according to Ray V. Hennen[11], and had a reported depth of 2900 feet, its bottom being in the Chemung Series 1750 feet below the top of the Big Injun Sand, having been abandoned as a dry hole, its detailed log not being available.

The following is the record of a hole drilled in Holly District, Braxton, less than one mile from the Webster line, its record having been previously published by the Survey[12]:

[11]Ibid., p. 343.

[12]Ibid., pp. 102-103.

Centralia Improvement Company No. 1 Well Record (16).

Holly District, Braxton County; on Elk River at Centralia; authority, Stewart Oil and Gas Company, through Diggins and Holden; elevation, 953' L.

	Thickness Feet	Total Feet
Conductor	40	40
Gravel	20	60
Coal, Gilbert	3	63
Fire clay and slate	32	95
Sand, white, hard, fine-grained, Nuttall	85	180
Coal, Hughes Ferry	7?	187
Slate	5	192
Limestone, hard	12	204
Shale and fire clay	56	260
Coal, Sewell "B"	5?	265
Slate and limestone	10	275
Shale and limestone	37	312
Coal, Sewell	5?	317
Fire clay and shale	36	353
Sand, white and hard, Rosedale Salt (showing of oil)	92	445
Shale, white and hard	60	505
Red shale and impure lime beds	135	640
Lime and hard shale	90	730
Fire clay and limy beds	22	752
Lime, red shale, and fire clay	80	832
Sand, white and black-grained, very hard	56	888
Red shales, lime and black slate or Pencil Cave	72	960
Big Lime	100	1060
Sand, Big Injun (oil at 1065')	195	1255
Shale, dark and fine-grained	50	1305
Sand, Squaw, Weir?	40	1345
Slate, black, and hard shale	45	1390
Slate, soft, and thin shales	35	1425
Rock, hard, coarse and pebbly, Berea Sand	10	1435
Slate, black	15	1450
Slate and limy shale	20	1470
Rock, hard and gritty	20	1490
Slate	12	1502
Sand, dark-red, very hard, Gantz	20	1522
Slate, black and hard shales	68	1590
Red rock, hard	12	1602
Slate	11	1613
Slate, very soft	37	1650
Shell, very hard	2	1652
Slate and shale	28	1680
Sand, coarse and pebbly, Gordon	28	1708
Shale, very hard on bits	42	1750
Slate, with a few hard shales	100	1850
Sand, dark-blue and coarse, Fifth	10	1860
Slate and shales	180	2040
Sand, dark and pebbly, Bayard	22	2062
Slate and hard shales	88	2150
Shale, hard and fine-grained	30	2180
Shale, with soft streaks	440	2620
Slate and shales, some very hard	340	2960
Unrecorded to bottom	58	3018

In the above record it seems quite certain that the thick coals noted should have been called a mixture of coal and slate, since several core drill holes in the same vicinity have proved that the Sewell is the only underground coal of consequence, and it is only 3 to 4 feet thick.

Prospective Oil and Gas Areas, Holly District. — The following locations are suggested as offering the most hope for oil and gas: (1). Based on the oil found in the Big Injun Sand at Centralia it would seem that a location on Elk River 3½ miles eastward from that place and one-half mile west of the mouth of Gulf Run might find gas in the same stratum since the rocks form an anticlinal nose of considerable proportion at that place, as shown by Map II. (2). Just west and southwest of Salisbury Station on Right Fork of Holly River, Map II shows that there is a flat terrace two miles long and half a mile or more in width that offers some hope of oil in the Big Injun or some other horizon. (3). In the vicinity of Diana and the Water Station along the West Virginia Midland Railroad the gentle upward rise of the rocks toward the southeast suddenly changes to a much more rapid rate and it might be possible that oil or gas would be found at one of these points. (4). The deep basin indicated on Map II along the axis of the Kovan Syncline at a point 1.2 miles above and southeast of Jumbo on Right Fork of Holly River would indicate the possibility of oil in the Berea Sand or in the Catskill Group of sands, all of which are usually non-water-bearing.

DETAILED WELL RECORDS AND PROSPECTIVE AREAS, FORK LICK DISTRICT.

Fork Lick District occupies the central and eastern portion of the county embracing portions of the Elk and Gauley Valleys. Only one deep test has been drilled for oil and gas, certain other shallow holes having been put down for mineral water without reaching the main oil sands. The district is traversed in a north and south direction by the Webster Springs Anticline and the Kovan Syncline, both affording considerable structural relief.

The **C. P. Dorr No. 1 (17) Well,** the record of which is published in connection with the section for Webster Springs (South), pages 97-98, was drilled by the Webster Springs Heat and Light Company and located on Elk River, in the suburbs of Webster Springs, 0.9 mile below the Court-House, its position being 1.3 miles below the point where the anticline crosses Elk. At this location the rocks are dipping sharply toward the northwest, forming a steep structural slope. The hole was a deep test, penetrating the sands of the Pocono and Catskill Series, and extending 473 feet into the Chemung in which no sands were found. Most of the principal sands were recorded in good development but only a pocket of gas was found in what is doubtfully correlated with the Elizabeth or Seventh Sand, although it may represent the Warren First.

Prospective Oil and Gas Areas, Fork Lick District. — Viewed from a structural standpoint alone, Fork Lick District is much favored by the presence of an anticline with its corresponding syncline, including a considerable doming along the former feature. This apparently hopeful structure is much discounted, however, by the tests almost barren of pay that have been drilled in and around the district. The following localities are suggested as the best possible for tests, the drilling of which, however, would be attended with much risk, and would hardly be justified in the light of present knowledge: (1). A location on Elk River at the point where the Webster Springs Anticline crosses the stream, one-half mile southeast of the court-house, would be a much more hopeful location than the test already drilled below the town. Such a well would start only a few feet above the top of the Big Lime and would be a suitable place to try out the Ohio deep sands, the estimated interval to which is given in the Table of Oil and Gas Sand Intervals, page 237. (2). Should gas in hopeful quantity be found where the anticline crosses Elk a location on Gauley, where the same fold crosses the stream, one mile east of Bolair, would follow as a natural development since the axis is rising southward toward the large dome at the Fork Lick-Glade District Line and there should be more gas at the second location suggested although

an additional well depth of about 700 feet would be necessary owing to the difference in level (800 feet) of the two rivers, counteracted to some extent by the southward rise of the strata. Should gas be found on Gauley the pay belt should increase southward toward the dome above mentioned. (3). The closed basin along the Kovan Syncline, having its deepest portion near the point where Turkey Creek empties into Gauley River, offers some hope of oil in the Berea and in the sands of the Catskill Series, all of which are usually free from salt water. A test at this point should reach the Berea Sand at about 1600 feet.

DETAILED WELL RECORDS AND PROSPECTIVE AREAS, GLADE DISTRICT.

Glade District comprises the southwestern portion of the county and includes portions of the Elk, Birch, Gauley, Williams, and Cranberry River drainage basins. Two tests have been drilled inside its limits, neither of which reported shows of oil or gas.

The **J. N. Camden No. 1 (20) Well,** the record of which is published in connection with the section for Camden-on-Gauley, pages 115-116, was a deep test drilled by the owner in the town of Camden-on-Gauley, the record being carefully kept. The hole starts 47 feet below the horizon of the Douglas "A" Coal and reached the bottom of the Pocono Series, having passed through the Big Injun, Weir, and Berea Sands, besides other more shallow horizons, its total depth being 2501 feet, with no recorded shows of oil or gas.

The following is the record of a hole drilled in the same region, starting about 150 feet below the horizon of the Eagle Coal:

Floyd Morton No. 1 Well Record (21).

Glade District; on Strouds Creek, 1 mile northwest of Allingdale; authority, Richard V. Dennison; drilling started September 9, 1914: elevation, 2070′ B.

	Thickness Feet	Total Feet
Slate	105	105
Sand, Lower Gilbert (hole full of water, 211′)	113	218
Slate, black	18	236
Sand shells	4	240
Slate, black	18	258
Sand, broken, Upper Nuttall (coal blossom at 318′)	65	323
Slate, black	51	374
Sand, Lower Nuttall	76	450
Slate, black	30	480
Coal, Hughes Ferry	1	481
Sand	25	506
Slate, black	5	511
Lime	36	547
Shells, lime and sand	33	580
Coal, Sewell	2	582
Sand	17	599
Slate, black	19	618
Shells, sand, and slate	92	710
Slate	80	790
Sand, white, Princeton Conglomerate	100	890
Slate, black	41	931
Sand, hard	17	948
Sand, shells, and slate	50	998
Shale, red, interspersed with sand shells	510	1508
Sand, hard	87	1595
Slate	42	1637
Lime, broken, Hinton	73	1710
Slate	9	1719
Lime, hard, Little Lime	13	1732
Slate, (very bad cave, 1763-1773′), Pencil Cave	41	1773
Lime, black, hard 25′ Slate 9 Lime, gray, gritty 193 — **Big Lime**	227	2000
Unrecorded to bottom of hole	170	2170

The **John N. Dodrill No. 1 (22) Well**, drilled by the Nicholas Oil and Gas Company in 1907 on Birch River at the mouth of Anthony Creek, Hamilton District, Nicholas County, 3½ miles west of the Webster line, the complete record of which could not be obtained, was reported by Mr. Dodrill to have been drilled 2700 feet deep, making some gas in the Big Injun (?) Sand at about 1400 feet but was abandoned. The **John N. Dodrill Sulphur Well (23)**, located alongside the oil test, was a shallow hole drilled primarily for salt water by

Addison McLaughlin a half century or more ago. This well, which had a reported depth of 750 feet, flows a copious stream of salt sulphur water from which inflammable gas emanates in considerable quantity, probably enough to supply a family if some container were provided to handle it. The producing horizon is unknown.

In the southeastern end of Glade District, no wells have been drilled, but on the Williams River, in Edray District, Pocahontas County, five miles east of the Webster line and 6.5 miles northwest of Marlinton, the record of the **Pocahontas County Coal and Land Company No. 1 (24) Well,** drilled by that corporation on its own land, is available and affords a fine record of the sand in that region. This well, the record of which has been published in connection with the section for Big Spruce Knob, page 123, starts 607 feet above the level of the Big Lime, and was drilled to a total depth of 3032 feet, penetrating 490 feet into the Chemung Series. A show of oil sufficient to grease the tools and bailer was found in the Big Injun Sand. The Berea Sand was 31 feet thick, but barren, and several good sands were noted in the Catskill, none of them being productive. No sands were reported in the Chemung.

Prospective Oil and Gas Areas, Glade District. — Calling attention first to the evident hazard of drilling at any point in the southern portion of Webster, the following localities are suggested as the most hopeful for oil and gas in Glade District: (1). At the extreme northwestern edge of the district, next to the Braxton line, the rocks form a cove-like structure on Brooks Creek, southwest of Prestonia, that, in view of the show of oil in the Big Injun Sand at Centralia, would indicate the possible presence of a commercial pool in that locality. (2). In the Williams River region a structurally perfect location for gas would be on the head of the Left Fork of Sawyer Run, slightly more than two miles northeast of Dyer, as the rocks at this point make a fine dome along the crest of the Webster Springs Anticline. (3). On the same river a test where the Kovan Syncline crosses the stream, just below the mouth of Whiteoak Run, would tap the low basin that ex-

tends from this point northward to the Gauley River, and would make the best possible location for oil in the Berea Sand and the Catskill Series. (4). Should gas be found on the dome northeast of Dyer, a similar occurrence might reasonably be expected at or near the point where the Webster Springs Anticline crosses the Webster-Nicholas line, just west of the Hanging Rock, as this point is evidently the edge of another similar dome.

CHAPTER X.

COMMERCIAL COAL.

In Chapters V to VII, inclusive, a systematic description of all the coal seams found in Webster has been given, together with their correlations. Some of the smaller beds that are not of commercial importance have been fully described, giving measured sections at openings and prospects. In the present Chapter numerous actual measured sections will be published for those coals that are of minable thickness and purity, and estimates of their probable tonnage, with etchings showing their areal extent, will be given. At the end of the Chapter there is a table of analyses, showing the chemical composition of all coals tested by the Survey, as well as a second table containing numerous analyses made by the Bethlehem Steel Company.

STATISTICS OF COAL PRODUCTION.

Webster County, although possessing an immense amount of good coal, has had but little commercial mining. Within the last few years three small operations have been started on Laurel Creek of Elk, along the Richwood Branch of the Baltimore and Ohio Railroad, mining the Campbell Creek (Peerless Bench), and the Lower Kittanning Coals. In the Holly River drainage one small operation mines the Cedar Grove seam along the main line of the West Virginia Midland Railroad, its product being used for railroad and domestic fuel along the line of this carrier. Another small plant has recently begun mining the Eagle Coal on a branch of the same narrow-gauge road, a transfer of its output to standard-gauge cars being required at Palmer, where connection is available with the Baltimore and Ohio. In the eastern edge of the county another small operation mines the Sewell Coal on Big

Sugar Creek, its product being carried by the Ranwood Lumber Company and Pickens and Hacker Valley narrow-gauge roads to Pickens where standard-gauge transportation is available through the Weston and Pickens Branch of the Baltimore and Ohio Railroad. All of these mines are drift openings, mining directly on the outcrop of the coals. The county has no coke production.

According to Hon. W. J. Heatherman, Chief of the State Department of Mines, the only production reported to that Department from Webster County is that of the Laurel Hill Mining Company, of Arcola, its output for the year ending June 30, 1918, being 3,702 tons.

In Webster there are 19 coals that appear to have minable thickness and 18 others too thin, impure, or irregular to be of more than local value. The minable seams, in descending order, are the Upper Freeport, Upper Kittanning, Middle Kittanning, and Lower Kittanning of the Allegheny Series; the Upper Mercer, Stockton, Coalburg, Winifrede, Chilton, Cedar Grove, Alma, Campbell Creek (Peerless Bench), Eagle, Lower War Eagle, and Gilbert of the Kanawha Group of the Pottsville; and the Hughes Ferry, Sewell, Welch, and Fire Creek of the New River Group of the Pottsville Series.

Figure 3 shows the different coal seams of Webster, giving not only their relative thickness, but also the maximum interval between them. Figures 4 to 22, inclusive, published in the present Chapter, will show, approximately, where each of the commercial seams occurs in possible minable thickness.

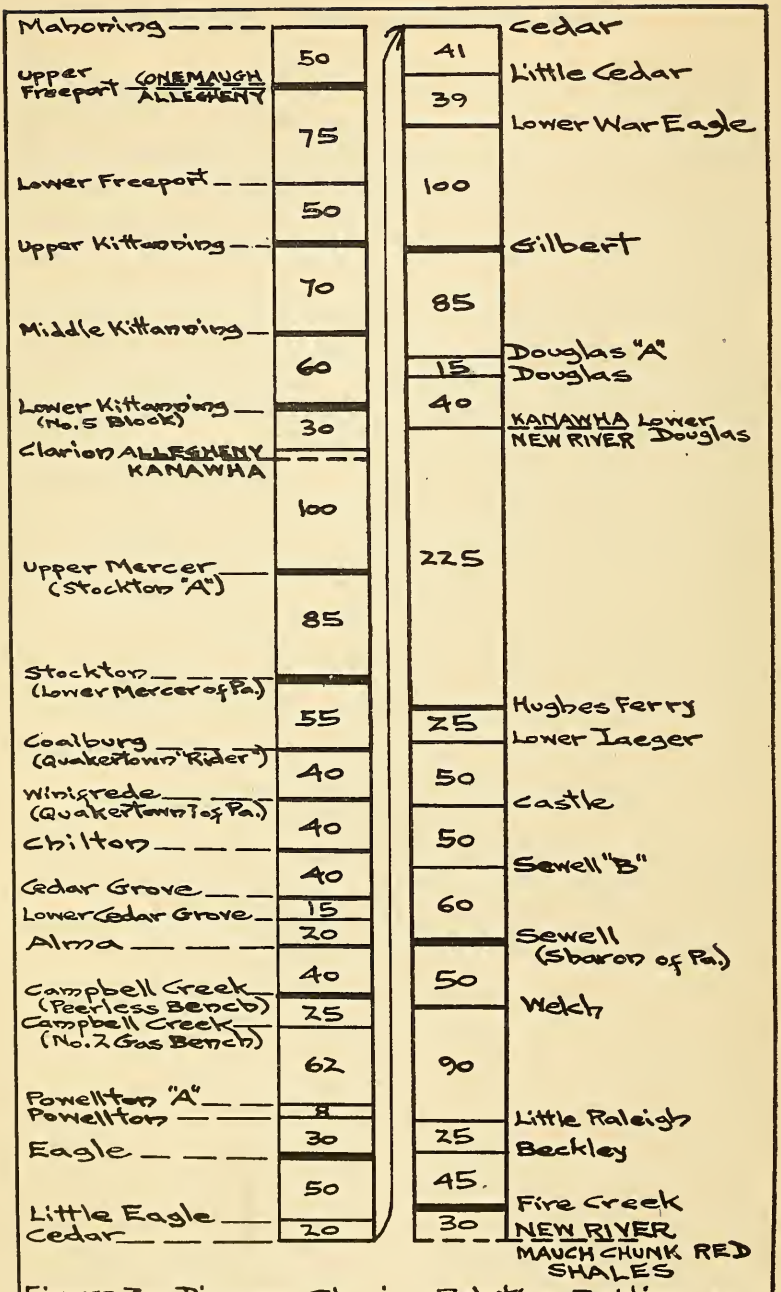

Figure 3.—Diagram Showing Relative Position of Coal Seams.

R.C.T.

RECORDS OF COAL TEST BORINGS.

SUMMARIZED RECORDS.

In Webster 16 tests for coal have been bored, all of them having been definitely located on Map II and their surface levels secured. Besides these tests 14 others have been made in adjoining counties that bear directly on the coal resources of Webster. An attempt was made to secure the records of these 30 borings for publication but owing to the inability or unwillingness of some of the operators who made them, only part of them have been obtained. The following table, while lacking some of the details that it should contain, gives the surface elevations and ownership of all the borings, and the condensed records of such as were secured. The first column gives the key number on Map II, by which the position of the borings may be found, and in the elevation column the letter "L" signifies a hand-level determination, and "B" indicates that the aneroid barometer was used, checked on the nearest Government elevation. The following abbreviations of company names have been used:

Beth. Steel	Bethlehem Steel Company
Berwind-White	Berwind-White Coal Company
Cutright Bros.	Cutright Brothers

Summarized Record of Tests for Coal in Webster County.

No. on Map II.	Name of Property.	Magisterial District.	Company.	Elevation above Tide, Feet.	Campbell Creek (Peerless) Coal		Eagle Coal		Sewell Coal		Welch Coal		Fire Creek Coal		Total Depth.	No. on Map II.
					Depth. Top.	Thickness Feet.	Depth. Top.	Thickness Feet.	Depth. Top.	Thickness Feet.	Depth. Top.	Thickness Feet.	Depth. Top.	Thickness Feet.		
1	Buckhannon Chem. No. 1	Middle Fork (Randolph)		1905B											320	1
2	J. A. McCauley	Middle Fork (Randolph)	Cutright Bros.	2335B			12	4							16	2
2A	Thomas No. 1	Middle Fork (Randolph)	Beth. Steel	2650B			168		467.9		509.7		549		605	2A
2B	Pickens No. 2	Middle Fork (Randolph)	Beth. Steel	3015B			126.6		432.1		460.2		522.6		552	2B
2C	Shock No. 3	Middle Fork (Randolph)	Beth. Steel	3310B	96.4		251.3		537.7		579.5		612.4		689	2C
2D	Winkler No. 4	Middle Fork (Randolph)	Beth. Steel	3400B			107.4		420.0		475		585.9		610	2D
3	Holly Lumber Co. water well	Huttonsville (Randolph)	Holly Lumber	2690B			56	4								3
3A	Ward & Hutton No. 2	Mingo (Randolph)	Berwind-White	3605B												3A
3B	Ward & Hutton No. 3	Mingo (Randolph)	Berwind-White	3390B												3B
3C	Ward & Hutton No. 1	Holly	Berwind-White	3780B												3C
4	Holly Lumber Co. No. 1	Holly	Holly Lumber	2345B												4
5	Holly Lumber Co. No. 2	Holly	Holly Lumber	2130B												5
6	John T. McGraw No. 1	Holly	J. T. McGraw	1540L					146	1.0					671	6
7	Neal Bros. No. 1	Holly	Beth. Steel	1100B					207						399	7
8	M. G. Brooks No. 3	Holly	Beth. Steel	1210B												8
9	Centralia Imp. Co. No. 2	Holly (Braxton)	Beth. Steel	953L					298.9	4.4					434	9
10	Neal Cool No. 2	Fork Lick	J. T. McGraw	2035B					153	2	170.7	0.3	281.8	0.3	320	10
11	Smoot Lumber Co. No. 3	Fork Lick	Beth. Steel													11
12	Smoot Lumber Co. No. 2	Fork Lick	Beth. Steel												100	12
13	Smoot Lumber Co. No. 1	Glade	Beth. Steel	2375B					538						556½	13
14	Marion Blankenship No. 1	Glade	E. J. D. Coxe	2360B					535	2						14
15	Ross F. Stout No. 1	Glade	Ross F. Stout	1910B												15
16	Wm. M. Giles No. 1	Glade	Ross F. Stout	1795B												16
17	Webster Lumber Co. No. 1	Glade	Dr. Newcomer	1565B											750?	17
18	J. F. Smith No. 1	Glade	Wm. F. Patterson	2233L											501	18
19	Thos. J. Given No. 1	Glade	E. J. D. Coxe	2300L												19
20	Tioga Lumber Co. No. 3	Glade	Tioga Lumber	1475B					369	0.5					614	20
21	Tioga Lumber Co. No. 1	Hamilton (Nicholas)	Tioga Lumber	1400B			56.1	0.1							100.3	21
22	Tioga Lumber Co. No. 2	Hamilton (Nicholas)	Tioga Lumber	1380B					489.8	0.6					589.7	22
23	A. J. Pettigrew No. 1	Beaver (Nicholas)	G. W. Boggs	2105B												23

DETAILED COAL TEST RECORDS, HACKER VALLEY DISTRICT.

No coal test borings have been made within the limits of Hacker Valley District, but in Middle Fork District, Randolph County, a few shallow tests are available that afford some slight information that is of value. The **Buckhannon Chemical Company No. 1 (1) Boring,** located at the forks of Buckhannon River just south of Newlon, the record of which has been previously published by the Survey[1], starts at or about the level of the Eagle Coal and was drilled to a total depth of 320 feet without finding other coal. The **J. A. McCauley No. 1 (2) Boring,** put down with a churn drill by Cutright Brothers at Silica on the Right Fork of Buckhannon River, is reported to have found the Eagle Coal at a depth of 12 feet and with a thickness of 4 feet. The **Holly Lumber Company water well (3),** put down by that company on its mill property in Pickens, is reported to have found the Eagle Coal at 56 feet, its thickness being 4 feet.

The **Thomas No. 1 (2A), Pickens No. 2 (2B), Shock No. 3 (2C), and Winkler No. 4 (2D) Core Tests,** all recently made by the Bethlehem Steel Company, in Middle Fork District, Randolph County, in the neighborhood of Pickens, as shown on Map II, were deep tests through all the coals. In the Summarized Record of Tests for Coal, the depths to the various coals are recorded, but the company stated through its Assistant Geologist, D. D. Teets, Jr., that the landowners refused permission to publish the thicknesses of the coals and they are therefore omitted from the table.

The **Ward and Hutton No. 2 (3A) Core Test,** situated in Huttonsville District, Randolph County, and the **Ward and Hutton No. 3 (3B), and Ward and Hutton No. 1 (3C) Core Tests,** situated in Mingo District, Randolph, along the divide between Back Fork of Elk River and the Tygart Valley River, as shown on Map II, were drilled by the Berwind-White Coal Company, but no information as to their depths or the coals encountered could be obtained.

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[1]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, p. 441; 1918.

DETAILED COAL TEST RECORDS, HOLLY DISTRICT.

Five diamond drill borings have been made in Holly District, all of them being put down to test the Sewell and other New River coals.

The **Holly Lumber Company No. 1 (4) Boring**, located on Sugar Creek, 3.5 miles eastward from Skelt, was put down by that company on its own property, its surface elevation being 2345′ B., its record not being available, according to J. F. Johnson, Superintendent. The hole starts about 75 feet below the level of the Sewell Coal.

The **Holly Lumber Company No. 2 (5) Boring**, located on Sugar Run of Sugar Creek, 0.4 mile northward from the present location of Skelt, starts 40 feet above the level of the Hughes Ferry Coal, its surface level being 2130′ B. According to Mr. Johnson the record of this test is not available.

The **John T. McGraw No. 1 (6) Boring**, put down by Hon. John T. McGraw at Jumbo on Left Fork of Holly River, starts 16 feet under what appears to be the Hughes Ferry Coal, its record, as published in connection with the section for Jumbo, pages 83-84, noting the Sewell at 146 feet, with a thickness of 1 foot, the total depth of the hole being 671 feet.

The **Neal Brothers No. 1 (7) Boring**, located in the western end of the District on Elk River, 2.2 miles east of Centralia, starts 80 feet below the Eagle Coal, its surface elevation being 1100′ B. The Sewell Coal, reported very thin, was found at a depth of 207 feet, the bottom of the hole being at 399 feet.

The **M. G. Brooks No. 3 (8) Boring**, located on Houston Run of Elk, 2.1 miles southeast of Centralia, with a surface elevation of 1210′ B., starts about 75 feet below the level of the Eagle Coal. No information as to its depth was obtained.

The **Centralia Improvement Company No. 2 (9) Boring**, located at Centralia on Elk River, with a surface elevation of 953′ L., starts near the horizon of the Eagle Coal and had a total depth of 434 feet, the Sewell Coal having been found at 299 feet, being reported 3 to 4 feet thick.

PLATE XVIII.—View of Elk-Holly Summit Cut along West Virginia Midland Railroad from south side; Topography of Allegheny and Pottsville Series.

DETAILED COAL TEST RECORDS, FORK LICK DISTRICT.

In Fork Lick District three tests have been bored to find the Sewell and other New River coals.

The **Neal Cool No. 2 (10) Boring,** located on Little Grassy Creek, 2.4 miles northward from Webster Springs and put down by Hon. John T. McGraw, starting at a surface elevation of 2035′ B., found the Sewell Coal at 153 feet with a thickness of 2 feet, the total depth of the hole being 320 feet, as noted in the section for Little Grassy Creek, page 94, where the detailed record is published.

The **Smoot Lumber Company No. 3 (11) Boring,** located on a short branch of Gauley River, 0.8 mile northwest of Bolair, was drilled by the Bethlehem Steel Company after field work was completed in the county, its elevation and record not being available.

The **Smoot Lumber Company No. 2 (12) Boring,** located on a branch of Gauley, 1.3 miles southwest of Bolair, its surface elevation not being available, was reported to have been drilled to a depth of 100 feet and abandoned.

DETAILED COAL TEST RECORDS, GLADE DISTRICT.

In Glade District eight holes have been bored, being mostly intended to test the Sewell and other New River coals.

The **Smoot Lumber Company No. 1 (13) Boring,** located on McAvoy Run of Laurel Creek, 1.5 miles west of Bolair, with a surface elevation of 2375′ B., is reported to have found the Sewell Coal at 538 feet.

The **Marion Blankenship No. 1 (14) Boring,** located on McAvoy Run of Laurel Creek, 1.6 miles west of Bolair, having a surface elevation of 2360′ B., is reported to have found the Sewell at a depth of 532 feet, its thickness being 2 feet.

The **Ross F. Stout No. 1 (15) Boring,** located on McAvoy Run, 0.5 mile south of Jack, and put down by Ross F. Stout and associates, starts 72 feet, by hand-level measurement, below the Eagle Coal. According to Mr. Stout the record has been lost.

The **William M. Giles No. 1 (16) Boring,** located on Laurel Creek, 0.6 mile southwest of Arcola and financed by

Ross F. Stout and associates, starts 90 feet below the Eagle Coal, its surface elevation being 1795′ B. According to Mr. Stout the record has been lost. A strong stream of slightly sulphurous water, estimated at 500 gallons per hour, flows from the casing mouth.

The **Webster Lumber Company No. 1 (17) Boring,** located on Laurel Creek, 0.4 mile northwest of Wainville, and put down by Dr. Newcomer, of Pennsylvania, starts 32 feet, by hand-level measurement, below the Eagle Coal, its surface elevation being 1565′ B. Its record was not obtained, but according to local report it was bored to a depth of 750 feet. A small stream of slightly sulphurous water flows from the well mouth.

The **J. F. Smith No. 1 (18) Boring,** located on Big Ditch Run of Gauley River at the southern edge of Cowen, and financed by Wm. F. Patterson, of Waynesburg, Pa., starts approximately 50 feet above the horizon of the Eagle Coal. The record of this boring, as given from memory by Mr. Patterson, is as follows:

J. F. Smith No. 1 Coal Test Record (18).

Glade District; on Big Ditch Run at Cowen; authority, Wm. F. Patterson; elevation, 2233′ L.

	Thickness Ft.	In.	Total Ft.	In.
Unrecorded	250	0	250	0
Coal, Lower War Eagle	1	6	251	6
Unrecorded	38	6	290	0
Coal, Gilbert	0	1	290	1
Unrecorded to bottom	210	11	501	0

The **Thomas J. Given No. 1 (19) Boring,** located on a short branch of Gauley River, 0.3 mile southwest of Upper Glade, and reported to have been put down by E. J. D. Coxe, of Philadelphia, Pa., its surface elevation being 2300′ L., starts 15 to 20 feet below the level of the Eagle Coal, its record not having been secured.

The following record, furnished the Survey by Mr. Leonard Harrison, President of the Tioga Lumber Company, is that of a boring starting 65 feet under the Eagle Coal and carefully supervised by Mr. Geo. A. Harrison, civil engineer

of the company, and gives much light on the underground strata in the western end of Glade District:

Tioga Lumber Company No. 3 Coal Test Record (20).

Glade District; on Birch River, 1.3 miles northwest of Birch River village; authority, Tioga Lumber Company; completed, March 31, 1917; elevation, 1475′ B.

	Thickness Ft.	In.	Total Ft.	In.
Surface	10	3	10	3
Shale, gray	2	7	12	10
Sandstone, **Decota**	30	4	43	2
Shale, gray	4	10	48	0
Sandstone	4	6	52	6
Coal, Little Cedar	0	6	53	0
Fire clay	0	2	53	2
Sandstone, **Lower War Eagle**	3	0	56	2
Coal, Lower War Eagle	0	10	57	0
Fire clay, impure	2	0	59	0
Shale, gray	9	0	68	0
Sandstone, **Lower Gilbert**	40	0	108	0
Coal, Gilbert	0	11	108	11
Shale, dark	5	1	114	0
Sandstone, **Dotson**	11	6	125	6
Shale, dark, sandy streaks	2	0	127	6
Shale, dark	44	2	171	8
Shale, gray	16	0	187	8
Sandstone, **Lower Dotson**	25	4	213	0
Bony (coal?), Lower Douglas	0	2	213	2
Fire clay	2	0	215	2
Slate, gray	5	10	221	0
Slate, black, soft	0	10	221	10
Shale, dark	4	2	226	0
Sandstone and gray shale, **Lower Nuttall**	10	0	236	0
Shale, dark	4	0	240	0
Slate and **coal, Hughes Ferry**	1	0	241	0
Fire clay, impure	2	0	243	0
Shales, gray	37	2	280	2
Sandstone, **Harvey**	12	9	292	11
Shale, dark, **Castle Coal horizon**	1	6	294	5
Sandstone	3	3	297	8
Shale, dark	3	2	300	10
Shale, gray	14	0	314	10
Sandstone	9	2	324	0
Shale, dark	4	8	328	8
Sandstone and gray shale 2′ 8″ } **Guyandot**	14	4	343	0
Sandstone 11 8 }				
Coal, Sewell "B"	0	10	343	10
Fire clay	12	0	355	10
Shale, dark	13	2	369	0
Coal, Sewell	0	6	369	6
Fire clay	2	0	371	6
Shale, gray	5	0	376	6
Shale, dark	6	9	383	3

	Thickness Ft.	In.	Total Ft.	In.
Fire clay	2	9	386	0
Shale, dark	9	6	395	6
Coal, Welch	0	4	395	10
Fire clay	7	0	402	10
Shale, dark	3	4	406	2
Fire clay	3	0	409	2
Shale, white	7	8	416	10
Slate, gray	7	6	424	4
Shale, dark	3	2	427	6
Fire clay	7	1	434	7
Sandstone, Upper Raleigh (Sharon)	33	10	468	5
Shale, sandy, gray, (base of Pottsville)	4	0	472	5
Shale, green	2	0	474	5
Shale, dark	13	0	487	5
Sandstone, hard	11	4	498	9
Shale, dark	2	0	500	9
Sandstone	10	0	510	9
Sandstone and shale	16	0	526	9
Sandstone	10	6	537	3
Shale, green, very sandy	2	8	539	11
Sandstone	9	4	549	3
Shale, gray	53	5	602	8
Slate, black and bony, Pluto Coal horizon	0	4	603	0
Shale, gray	6	0	609	0
Shale, green	5	0	614	0

The following is the record of a shallow boring made in the edge of Nicholas County by the same company:

Tioga Lumber Company No. 1 Coal Test Record (21).

Hamilton District, Nicholas County; on Anthony Creek at the mouth of Rich Fork, 3.8 miles northwest of Tioga; authority, Tioga Lumber Company; completed, September 24, 1907; elevation, 1400′ B.

	Thickness Ft.	In.	Total Ft.	In.
Surface	4	0	4	0
Slate, streaked with sandstone	34	0	38	0
Fire clay	4	0	42	0
Sandstone	3	0	45	0
Sand slate	11	0	56	0
Coal, Lower War Eagle	0	1	56	1
Fire clay	2	8	58	9
Slate, dark	29	3	88	0
Fire clay	3	6	91	6
Sand shale	8	10	100	4

The following record, carefully kept by Mr. Geo. A. Harrison, is that of a boring that starts 640 feet below the Lower Kittanning Coal, and exhibits the apparent northwestern disappearance of the New River coals:

Tioga Lumber Company No. 2 Coal Test Record (22).

Hamilton District, Nicholas County; on Anthony Creek, 4.3 miles northwest of Tioga; authority, Tioga Lumber Company; completed, February 9, 1917; elevation, 1380′ B.

	Thickness Ft.	In.	Total Ft.	In.
Surface	12	0	12	0
Shale, gray, sandy	44	0	56	0
Slate, black	13	0	69	0
Coal 2′ 2″ / Fire clay, dark, sandy 1 6 / Sandstone, soft 3 6 / Coal 1 1 — Lower War Eagle	8	3	77	3
Fire clay, dark	0	3	77	6
Slate, gray	23	6	101	0
Coal 0′ 10″ / Fire clay, light 0 10 / Fire clay, black 0 10 / Fire clay, light 0 7 / Coal 0 2 — Gilbert	3	3	104	3
Fire clay	4	0	108	3
Slate, gray, with some black	56	0	164	3
Sandstone, hard, with coal spars	2	9	167	0
Slate, black	9	0	176	0
Shale, sandy	4	0	180	0
Sandstone, soft, Dotson	6	3	186	3
Shale, gray	3	9	190	0
Shale, dark	0	6	190	6
Slate, cannel, black	5	0	195	6
Coal, slightly bony 1′ 5″ / Bone 0 4 — Douglas	1	9	197	3
Shale, black	2	5	199	8
Slate, dark-gray	5	0	204	8
Sandstone, hard, with coal spars	0	10	205	6
Shale, gray	1	0	206	6
Sandstone, hard, with coal spars	4	0	210	6
Coal, Lower Douglas	0	10	211	4
Fire clay	2	5	213	9
Sandstone, soft 31′ 6″ / Sandstone, hard, with coal spars 6 0 — Upper Nuttall	37	6	251	3
Fire clay, dark	1	3	252	6
Shale, sandy	4	0	256	6
Shale, black	3	0	259	6
Shale, gray, sandy	47	0	306	6
Shale, gray	22	0	328	6
Fire clay	8	0	336	6
Shale, sandy	28	0	364	6
Sandstone, soft, Lower Nuttall	26	0	390	6
Fire clay	5	0	395	6
Slate, black, with coal spars and several streaks of bony coal, Hughes Ferry	4	0	399	6
Fire clay	1	6	401	0
Fire clay, sandy	3	0	404	0
Fire clay, very pure	2	5	406	5

	Thickness Ft.	In.	Total Ft.	In.
Sandstone, soft	24	0	430	5
Shale, gray, sandy	12	0	442	5
Slate, dark	6	6	448	11
Coal, bony, Castle	0	4	449	3
Shale, gray	7	5	456	8
Shale, sandy	4	2	460	10
Fire clay, sandy	1	4	462	2
Slate, black	9	0	471	2
Coal, Sewell "B"	0	9	471	11
Fire clay, impure	0	8	472	7
Sandstone, soft	11	6	484	1
Shale, sandy	4	3	488	4
Slate, dark-gray	1	6	489	10
Coal, Sewell	0	7	490	5
Slate, black	4	1	494	6
Fire clay, impure	6	2	500	8
Slate, gray	6	1	506	9
Shale, sandy	10	3	517	0
Slate, dark-gray	11	3	528	3
Slate, black	5	10	534	1
Coal, bony, Welch	0	2	534	3
Fire clay, impure	2	7	536	10
Slate, black	2	0	538	10
Slate, dark-gray	3	2	542	0
Fire clay, impure	3	6	545	6
Coal, Fire Creek?	0	2	545	8
Fire clay, hard, sandy	11	7	557	3
Shale, gray	4	8	561	11
Slate, black	6	1	568	0
Fire clay, **(base of Pottsville)**	6	0	574	0
Shale, red	1	0	575	0
Slate, black	2	0	577	0
Fire clay, mottled with red shale	7	4	584	4
Sandstone. soft, shaly	4	0	588	4
Shale, gray	0	4	588	8
Core left in hole	1	0	589	8

The **Albert J. Pettigrew No. 1 (23) Boring**, located on Beaver Creek, Beaver District, Nicholas County, 0.2 mile south of Beaver village, and having a surface elevation of 2105′ B., starts 50 feet, by hand-level measurement, below the Gilbert Coal. According to local report it was drilled by G. W. Boggs, of Columbus, Ohio.

MINABLE COALS OF THE ALLEGHENY SERIES.

UPPER FREEPORT COAL.

The Upper Freeport Coal, discussed previously in Chapter V, page 131, and shown by outcrop lines on Map II in those regions where it occurs in minable thickness, has been prospected at a few points in northwestern Webster where it

occurs high in the hilltops in Hacker Valley, Holly, and Glade Districts. Owing to the presence of other good coals more easily accessible below it, the Upper Freeport has been mined but little, but in future years these isolated tracts will doubtless be sought for and mined on a commercial scale. In Webster it is usually medium-soft, multiple-bedded, and of the typical coking character, its thickness ranging from 2 to 4 feet. Figure 4 shows its probable minable area. Because of the fact that suitable openings were not available, no sample of this coal was collected for analysis in the county, but the following average analysis of Upper Freeport Coal from three mines in the adjoining county of Upshur, as published in a previous Report of the Survey[2], should fairly represent it in Webster:

	Per cent.
Moisture	0.75
Volatile Matter	38.62
Fixed Carbon	52.06
Ash	8.57
Total	100.00
Sulphur	1.66
Phosphorus	0.018

[2]D. B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Survey, p. 740; 1918.

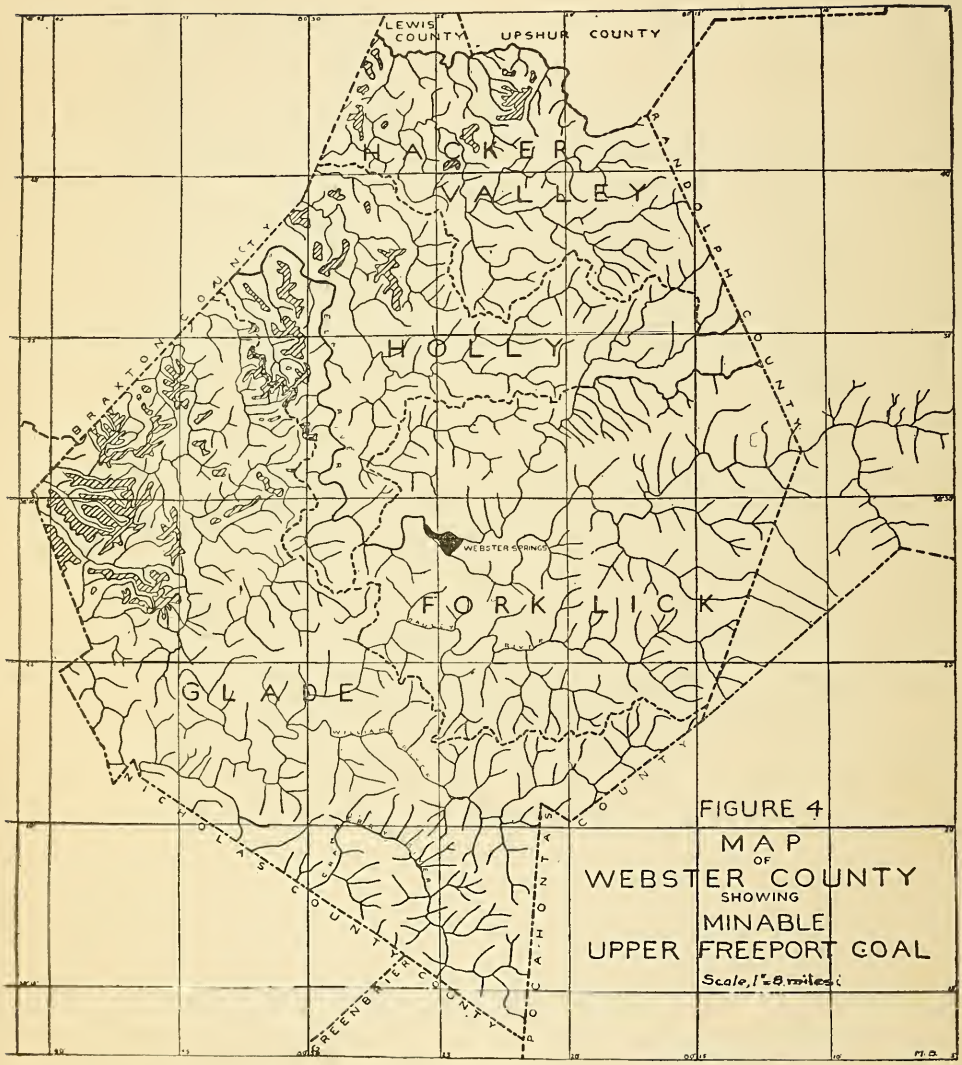


FIGURE 4

MAP OF WEBSTER COUNTY SHOWING MINABLE UPPER FREEPORT COAL

Scale, 1" = 8 miles.

Upper Freeport Coal, Hacker Valley District.

In Hacker Valley District, the Upper Freeport Coal crops in some of the high ridges in the northwestern corner next to Braxton, Lewis, and Upshur. At **Exposure No. 1 on Map II,** on the ridge road 0.6 mile northward from Replete, the blossom of the coal is visible at an elevation of 1765′ B. So far as known it has not been prospected in the district.

Upper Freeport Coal, Holly District

In Holly District the Upper Freeport Coal is found in certain of the high ridges of the western portion next to Braxton County. At the following point it was prospected along its outcrop with the Halberstadt hand auger as reported by Capt. Baird Halberstadt, of Pottsville, Pa.:

J. M. Brockerhoff Prospect—No. 2 on Map II.

On Houston Run of Elk River, 2.7 miles southwest of Centralia; **Upper Freeport Coal;** elevation, 2063′ B.

			Ft.	In.
Coal	1′	0″		
Parting	0	6		
Coal	2	7	4	1

Farther up Elk the coal has been opened and used for local fuel:

John Tharp Farm Mine—No. 3 on Map II.

On the south side of Elk River, 2 miles northwest of Summit Station; **Upper Freeport Coal;** elevation, 2385′ B.

			Ft.	In.
Coal, visible	1′	0″		
Shale, gray	0	11		
Coal, soft	1	8		
Slate, bony	0	3		
Coal, hard	2	9	6	7

Slate, bony, pavement

A sample (No. 45) was collected from this opening by D. D. Teets., Jr., the composition of which is published under **Mine No. 3** in the Bethlehem Steel Company table of coal analyses at the end of this Chapter.

Upper Freeport Coal, Glade District.

In Glade District the Upper Freeport is found in the high ridges along the western edge, next to the Braxton County Line, mainly along the Laurel Creek drainage. The **A. J. Blankenship Farm Mine (No. 4 on Map II)**, located on the ridge between Brooks Creek and Laurel, 0.8 mile northwest of Defoe, at an elevation of 1925′ B., had fallen shut but was reported to have measured 4 feet of clean coal.

On the ridge between Brooks Creek and Little Birch River it is visible at several points along the highway, often showing a heavy blossom. At **Exposure No. 5 on Map II**, 2.5 miles northwest of Erbacon, it has an elevation of 1950′ B. At **Exposure No. 6 on Map II**, 2.2 miles northwest of Erbacon, it shows 2 to 3 feet of coal in the road at an elevation of 2045′ B. At **Exposure No. 7 on Map II**, 1.8 miles northwest of Erbacon, its blossom its visible at an elevation of 2080′ B. At **Exposure No. 8 on Map II**, 1.4 miles northwest of Erbacon, its outcrop has an elevation of 2120′ B. At **Prospect No. 9 on Map II**, 1.3 miles northwest of Erbacon, the coal had once been opened but had fallen shut, its elevation being 2140′ B.

On the same dividing ridge where it extends westward between the waters of Little Birch River and Missouri Creek of Laurel, the coal is visible at several points. At **Exposure No. 10 on Map II**, 1 mile west of Erbacon, its blossom has an elevation of 2245′ B. At **Exposure No. 11 on Map II**, 1.3 miles westward from Erbacon, it is visible at an elevation of 2185′ B. At **Exposure No. 12 on Map II**, 1.8 miles west of Erbacon, its elevation is 2200′ B.

Farther west along the same ridge, the coal was once opened at the **James Rose Prospect (No. 13 on Map II)**, in Hamilton District, Nicholas County, 0.8 mile north of Skyles, at an elevation of 2125′ B., its thickness being reported as 2 feet, this point being about one-half mile from the Webster line.

On the east side of Laurel Creek, the coal was once opened at the **Robert Carpenter Prospect (No. 14 on Map II)**,

on the head of Carpenter Fork, 1.8 miles eastward from Erbacon, at an elevation of 2280′ B. This opening had fallen shut, no report being obtained on its thickness.

Quantity of Upper Freeport Coal Available.

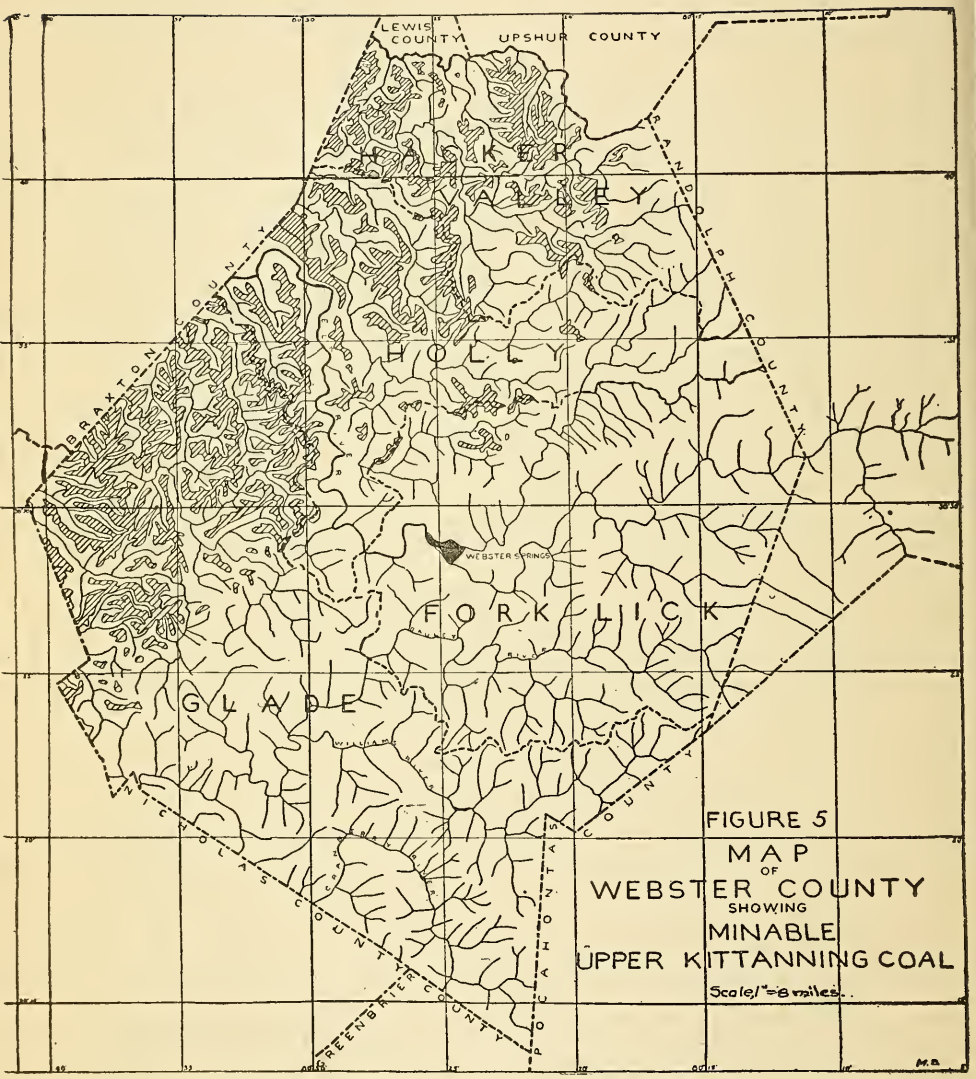
The following table, compiled by Miss Buchanan from a planimetric measurement of the outcrop of the coal on Map II, shows the probable amount of Upper Freeport Coal in the county in those districts which contain it:

Probable Amount of Upper Freeport Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	2	1.03	659.2	57,429,504	2,297,180
Holly	2	2.32	1,484.8	129,355,776	5,174,231
Glade	2	7.72	4,940.8	430,442,496	17,217,700
Totals		11.07	7,084.8	617,227,776	24,689,111

UPPER KITTANNING COAL.

The Upper Kittanning Coal, previously discussed in Chapter V, page 134, and shown by outcrop lines on Map II in that portion of the county where its horizon occurs, is found in the high ridges of the northwestern portion of the county. It has been opened for local use at several points where it exhibits a thickness of 2 to 5 feet, usually having a small slate parting in the lower portion of the seam. Such chemical analyses as are available show it to be high in volatile matter and low in sulphur. Figure 5 shows its areal extent.


LEWIS COUNTY
UPSHUR COUNTY
BAKER
VALLEY
HOLLY
RANDOLPH COUNTY
BRAXTON COUNTY
WEBSTER SPRINGS
FORK LICK
GLADE
NICHOLAS COUNTY
GREENBRIER COUNTY
POCAHONTAS COUNTY
FIGURE 5
MAP
OF
WEBSTER COUNTY
SHOWING
MINABLE
UPPER KITTANNING COAL
Scale, 1"=8 miles.

Upper Kittanning Coal, Hacker Valley District.

In Hacker Valley District the Upper Kittanning Coal crops in the high ridges of the western and central portion, not being found at all in the eastern end where the rise of the rocks has elevated its horizon above the hilltops.

The **Wesley Springer Farm Mine (No. 18 on Map II)**, located on Threelick Run of Right Fork of Little Kanawha River, 1.1 miles northeast of Replete, at an elevation of 1755′ B., had fallen shut, but the coal was reported 4 feet thick. On the same stream it was once opened at the **Wesley Springer Prospect (No. 19 on Map II)**, 1 mile northeast of Replete, at an elevation of 1690′ B., but this opening also had fallen shut, its thickness not being obtained.

On the north side of the Little Kanawha River, 0.7 mile north of Cleveland, it has been opened in Banks District, Upshur County, at the **John Beverage Farm Mine (No. 20 on Map II)**, where, as exhibited in the section for Cleveland, page 69, it is 3′ 7″ thick with a shale parting near the top, its elevation being 1780′ L.

At the following opening it has been mined for local fuel, showing a good thickness:

Charles Dever Farm Mine—No. 21 on Map II.

On the head of Buffalo Run of Little Kanawha River, 2.5 miles southeast of Cleveland; **Upper Kittanning Coal**; elevation, 2120′ B.

			Ft.	In.
1. Sandstone, massive			10	0
2. Shale, gray			2	0
3. **Coal**, splinty	3′	5″		
4. Slate, bony	0	5		
5. **Coal**, splinty	1	1		
6. **Coal**, medium-soft	1	1	6	0
7. Slate, pavement				

A sample (No. 166R) was collected from Nos. 3, 5, and 6 at this opening, the composition of which is published under **Mine No. 21** in the Survey Table of Coal Analyses at the end of this Chapter.

Farther up the Little Kanawha, the following opening was noted:

P. N. Johnson Farm Mine—No. 22 on Map II.

On Right Fork of Little Kanawha River, 1.1 miles southeast of Cleveland; **Upper Kittanning Coal**; elevation, 1930′ B.

			Ft.	In.
Slate, dark			5	0
Coal	0′	9″		
Slate, black	0	2		
Coal	1	7		
Slate, black	0	4		
Coal	0	10	3	8
Slate, pavement			....	....

On the waters of Left Fork of Holly River, the following opening seems to be the Upper Kittanning, although it may possibly be the Middle Kittanning instead:

Howard Arbogast Farm Mine—No. 23 on Map II.

On Big Run of Left Fork of Holly River, 3.5 miles eastward from Hodam; **Upper Kittanning Coal**; elevation, 2800′ B.

			Ft.	In
Slate, dark				
Coal, soft	2′	0″		
Coal, hard, bony splint	1	0		
Slate, hard	0	3		
Coal, medium-soft	2	6	5	9
Slate, pavement				

Upper Kittanning Coal, Holly District.

In Holly District the Upper Kittanning belongs in the high ridges of the central and western portion but in the eastern edge, next to Randolph County, its horizon is above the hills.

On Left Fork of Holly it has been opened at **Prospect No. 24 on Map II**, located 1.8 miles northward from Jumbo, being near the high summit where the Hacker Valley road crosses Hodam Mountain. Here it shows a thickness of 1′ 10″, as exhibited in the section for Jumbo, page 82, its elevation being 2542′ L.

On Right Fork of Holly River it was once opened at the **M. P. Brooks Prospect (No. 25 on Map II)**, opposite the mouth of Laurel Fork, 2.3 miles southeast of Jumbo, where its thickness was reported as 2 feet by Mr. Brooks, as noted

in the section for Laurel Fork of Holly, page 85, its elevation being 2515′ B.

On Elk River the coal was once opened at the **Thomas McCourt Prospect (No. 26 on Map II)**, located on the south side of the stream, 1.5 miles westward from Summit Station, at an elevation of 2360′ B. The prospect has fallen shut but according to Mr. McCourt it showed a thickness of 5 feet, with partings.

Upper Kittanning Coal, Fork Lick District.

In Fork Lick District, so far as known, the Upper Kittanning has not been prospected but it belongs in some of the high ridges in the northwestern corner, as shown by Map II and Figure 5.

Upper Kittanning Coal, Glade District.

In Glade District, the Upper Kittanning is found in the northwestern portion, next to Nicholas County, but in the central and southeastern region its horizon is above the mountain tops.

Several openings were observed on the waters of Laurel Creek of Elk River, as follows:

Henry Waggy Mine---No. 27 on Map II.

On a branch of Missouri Creek, 1.9 miles west of Erbacon; **Upper Kittanning Coal**; elevation, 1890′ B.

			Ft.	In.
1.	Slate, black			
2.	**Coal**, soft	0′ 6″		
3.	**Coal**, hard, splinty	0 11		
4.	Bone	0 2		
5.	**Coal**	0 7		
6.	Bone	0 2		
7.	**Coal**, hard, splinty	0 8		
8.	**Coal**, soft	1 0	4	0
9.	Slate, pavement		----	----

A sample (No. 188R) was collected from Nos. 2, 3, 5, 7, and 8 of section, the composition of which is published under **Mine No. 27** in the Survey Table of Coal Analyses at the end

of this Chapter. Coal from this mine has been used for railroad fuel on the narrow-gauge logging railroad that passes by the mine mouth.

The **S. L. Mason Farm Mine (No. 28 on Map II)**, on Missouri Creek, 2.4 miles southwest of Erbacon, measured 3′ 8″, with partings, as exhibited in the section for Missouri Creek, page 109.

The following opening was noted by R. M. Gawthrop:

Dr. J. B. Gregg Prospect—No. 28A on Map II.

On the head of Little Birch River, 1.8 miles northwest of Erbacon; **Upper Kittanning Coal**; elevation, 1920′ B.

			Ft.	In.
Sandstone, massive, gray, visible			10	0
Coal, splinty	0′	10″		
Coal, softer	1	8		
Coal, splint	2	2	4	8
Shale				

Homer Malcolm Farm Mine—No. 29 on Map II.

On Road Fork of Lost Run of Laurel Creek, 0.5 mile northeast of Arcola; **Upper Kittanning Coal**; elevation, 2480′ B.

			Ft.	In.
Shale, sandy, with ferruginous limestone			10	0
Coal, soft	0′	11″		
Slate, black, hard	0	4		
Coal, medium-hard	1	8	2	11
Slate, pavement				

On Birch River the coal has been prospected and its quality and thickness are very good as the following openings will show:

John Wilson Farm Mine—No. 30 on Map II.

On Laurel Fork of Birch River, 1.3 miles northeast of Boggs; **Upper Kittanning Coal**; elevation, 2340′ B.

			Ft.	In.
Sandstone				
Shale, dark			4	0
Coal, medium-hard	1′	6″		
Coal, hard, splint	1	6		
Coal, soft	0	9		
Coal, hard	0	4	4	1
Slate, pavement				

PLATE XIX.—Looking down Grassy Creek from West Virginia Midland Railroad; Topography of Allegheny Series in mountain at background, and Pottsville in foreground.

Henry Good Farm Mine—No. 31 on Map II.

On Laurel Fork of Birch River, 1.5 miles northeast of Boggs; **Upper Kittanning Coal**; Butts, N. 78° W.; elevation, 2340′ B.

			Ft.	In.
1. Slate, black				
2. **Coal**, splinty	1′	8″		
3. **Coal**, bony splint	1	0½		
4. **Coal**, soft	0	8½	3	5
5. Slate, pavement				

A sample (No. 190R) was collected from Nos. 2, 3, and 4 of section, the composition of which is published under **Mine No. 31** in the Survey Table of Coal Analyses at the end of this Chapter. At this opening the coal has been mined extensively for domestic use, being known as the "Good" Coal.

Quantity of Upper Kittanning Coal Available.

The following table, compiled by Miss Buchanan, from a planimetric measurement of the outcrop of the coal on Map II, shows the probable amount of Upper Kittanning Coal by districts in the county:

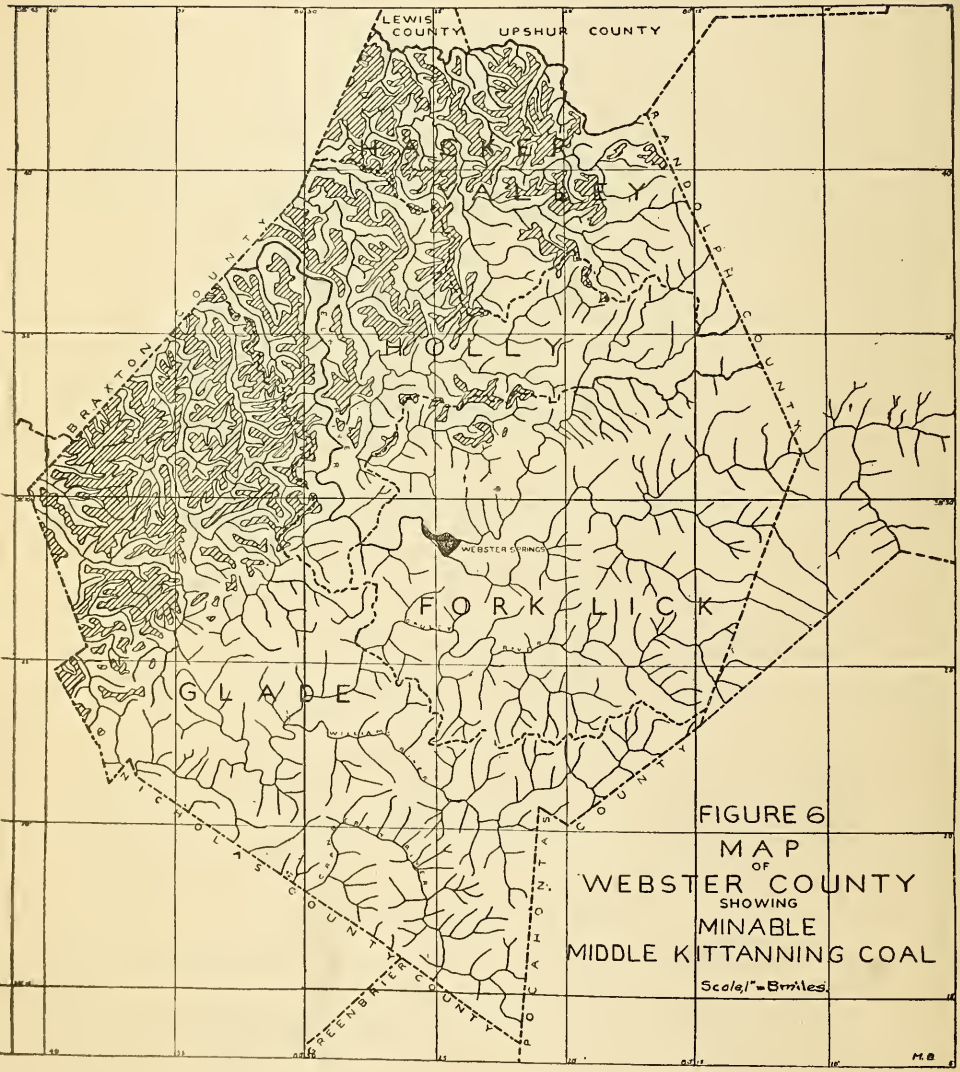
Probable Amount of Upper Kittanning Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short tons of Coal
Hacker Valley	3	9.71	6,214.4	812,097,792	32,483,912
Holly	3	10.92	6,988.8	913,296,384	36,531,855
Fork Lick	3	0.72	460.8	60,217,344	2,408,694
Glade	3	22.62	14,476.8	1,891,828,224	75,673,129
Totals		43.97	28,140.8	3,677,439,744	147,097,590

MIDDLE KITTANNING COAL.

The Middle Kittanning Coal, previously discussed in Chapter V, page 136, and shown by outcrop lines on Map II in that portion of the county where its horizon occurs, is found in the high ridges in the northwestern portion of the county,

its southeastern limits extending slightly farther southeast than the Upper Kittanning. It has been prospected and opened for local use at a few infrequent points, being from 2 to 5 feet in thickness, multiple-bedded, and rather high in ash. Figure 6 shows its areal extent.



Middle Kittanning Coal, Hacker Valley District.

In Hacker Valley District the Middle Kittanning is found in the central and western portions but in the eastern end, next to Randolph County, its horizon has risen above the tops of the ridges. At **Prospect No. 32 on Map II,** on Threelick Run of Right Fork of Little Kanawha River, 1.2 miles northward from Poling, the coal was once opened at an elevation of 1665′ B., but apparently little was found. At the **Alexander Anderson Prospect (No. 33 on Map II),** located on the head of Jerry Run of Little Kanawha River, 2.4 miles northeast of Hacker Valley, the coal was once opened at an elevation of 2205′ B., but had fallen shut, its thickness being 5 feet, according to Mr. Anderson.

On Hodam Creek of Left Fork of Holly River, the coal was once opened at **Prospect No. 34 on Map II,** 0.5 mile westward from Hodam village, its approximate elevation being 2475′ B., and its thickness 2 feet, according to Ballard Carpenter.

Middle Kittanning Coal, Holly District.

In Holly District the Middle Kittanning is found in the central and western portions, but, in the eastern end, next to Randolph County, its horizon is above the tops of the ridges. The **J. M. Brockerhoff Prospect (No. 34A on Map II),** located on Houston Run of Elk River, 2.7 miles southeast of Centralia, at an elevation of 1853′ B., measured 4′ 4″ with partings, as detailed in the section for Houston Run, page 91. Another point it was observed in the district was at the **W. B. Tracy Prospect (No. 35 on Map II),** on the south side of Elk River, 1.3 miles southwest of Tracy Switch, where it is 3′ 0″ thick, at an elevation of 2490′ B., being only 15 feet above the base of the Lower Kittanning which is opened just below it.

Middle Kittanning Coal, Fork Lick District.

In Fork Lick District the Middle Kittanning occurs in the high ridges of the extreme northwestern corner, but, so far as known, has not been prospected.

Middle Kittanning Coal, Glade District.

In Glade District the Middle Kittanning is found in the western third, next to Nicholas and Braxton Counties, its horizon being above the tops of the ridges in the central and southeastern part. It has been prospected mainly on the headwaters of Birch River and Muddlety Creek, the following openings having been noted:

Keystone Lumber and Mining Company Prospect—No. 36 on Map II.

On a branch of Jacks Run of Birch River, 3 miles northwest of Cowen; **Middle Kittanning Coal**; elevation, 2447′ B.

		Ft.	In.
Sandstone			
Slate, dark		5	0
Coal, soft	1′ 0″ to 1′ 4″		
Slate, gray	0′ 5″ to 0 1		
Coal, splinty	6 8	8	1
Slate to Lower Kittanning Coal		2	0

Keystone Lumber and Mining Company Prospect—No. 37 on Map II.

On the head of Jacks Run of Birch River, 3 miles northwest of Cowen; **Middle Kittanning Coal**; elevation, 2441′ B.

		Ft.	In.
1. Slate, dark			
2. **Coal**, soft	0′ 9″		
3. Shale, gray	0 3		
4. **Coal**, hard, splinty	5 0	6	0
5. Interval to top of Lower Kittanning Coal		11	0

A sample (No. 187R) was collected from a freshly dug stock pile, presumably representing Nos. 2 and 4 of section, the composition of which is published under **Mine No. 37** in the Survey Table of Coal Analyses at the end of this Chapter.

Black Betsey Coal Company Prospect (Opened by Davis-Eakin Lumber Company)—No. 38 on Map II.

On Road Fork of Skyles Creek, 2.5 miles eastward from Skyles; **Middle Kittanning Coal**; elevation, 1993′ B.

		Ft.	In.
Shale, sandy		5	0
Coal, slaty	1′ 11½″		
Slate, gray	0 0½		
Coal, slaty	2 10	4	10
Slate, concealed, and slate to Lower Kittanning Coal		21	7

Tioga Lumber Company Prospect (Margaret Strange Opening)—No. 39 on Map II.

On branch of Barnet Run of Birch River, at the Webster-Nicholas line, 1.5 miles westward from Boggs; **Middle Kittanning Coal**; elevation, 2202′ B.

		Ft.	In.
1. Shale, sandy			
2. **Coal**, medium-soft	2′ 7″		
3. **Coal**, hard, bony splint	2 3	4	10
4. Slate, concealed, and slate to Lower Kittanning Coal		15	5

A sample (No. 244R) was collected from Nos. 2 and 3 of section, the composition of which is published under **Mine No. 39** in the Survey Table of Coal Analyses at the end of this Chapter.

The **Tioga Lumber Company Prospect (No. 40 on Map II)**, located on the head of Barnet Run of Birch River, 1.7 miles northward from Tioga, at an elevation of 2305′ B., had fallen shut, but was reported to have measured 2 feet of coal, according to George A. Harrison, engineer of the company, being 15 feet above the top of the Lower Kittanning Coal.

The **Tioga Lumber Company Prospect (No. 41 on Map II)**, located on Beaver Creek of Muddlety Creek, 1.9 miles northeast of Tioga, had fallen shut, but its thickness was reported 5′ 0″ by Mr. Harrison, its elevation being 2353′ L., and the base of the coal coming 8′ 7″ above the top of the Lower Kittanning.

Tioga Lumber Company Prospect—No. 42 on Map II.

On Beaver Creek, 1.6 miles northeast of Tioga; **Middle Kittanning Coal**; elevation, 2332′ L.

			Ft.	In.
Slate				
Coal, bony	2′	11″		
Bone	0	3		
Coal, bony	1	9	4	11
Slate, pavement				
Interval to top of Lower Kittanning			11	0

The **Tioga Lumber Company Prospect (Richard Hammond Opening—No. 43 on Map II)**, located on Oldhe Fork of Beaver Creek, 1.6 miles northeast of Tioga, had fallen shut and its thickness was not obtained, its elevation being 2405′ B., and its interval above the base of the Lower Kittanning 15 feet.

Quantity of Middle Kittanning Coal Available.

The following table, compiled by Miss Buchanan from a planimetric measurement of the crop of the coal on Map II, shows the probable amount of Upper Kittanning Coal by districts in the county:

Probable Amount of Middle Kittanning Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	3	18.60	11,904	1.555,614,720	62,224,589
Holly	3	17.75	11,360	1,484,524,800	59,380,992
Fork Lick	3	1.40	896	117,089,280	4,683,571
Glade	4	34.10	21,824	3,802,613,760	152,104,550
Totals		71.85	45,984	6,959,842,560	278,393,702

LOWER KITTANNING (NO. 5 BLOCK) COAL.

The Lower Kittanning (No. 5 Block) Coal, previously discussed in Chapter V, pages 137-8, and shown by outcrop lines on Map II in those portions of the county where it occurs, is found in the ridges of the northwestern portion of the county, its horizon passing above the tops of the mountains not far from the center line of the county as drawn from northeast to southwest. In the region of its occurrence it has been prospected and mined for local use at numerous points, being 4 to 10 feet thick, multiple-bedded, and usually of the soft, coking type. As a commercial seam it can be made to produce a large tonnage of easily minable coal, though the expense of removing the bone and slate will detract largely from the profits of mining. Its chemical character is exhibited in the Tables of Coal Analyses at the end of this Chapter. Figure 7 shows its areal extent.

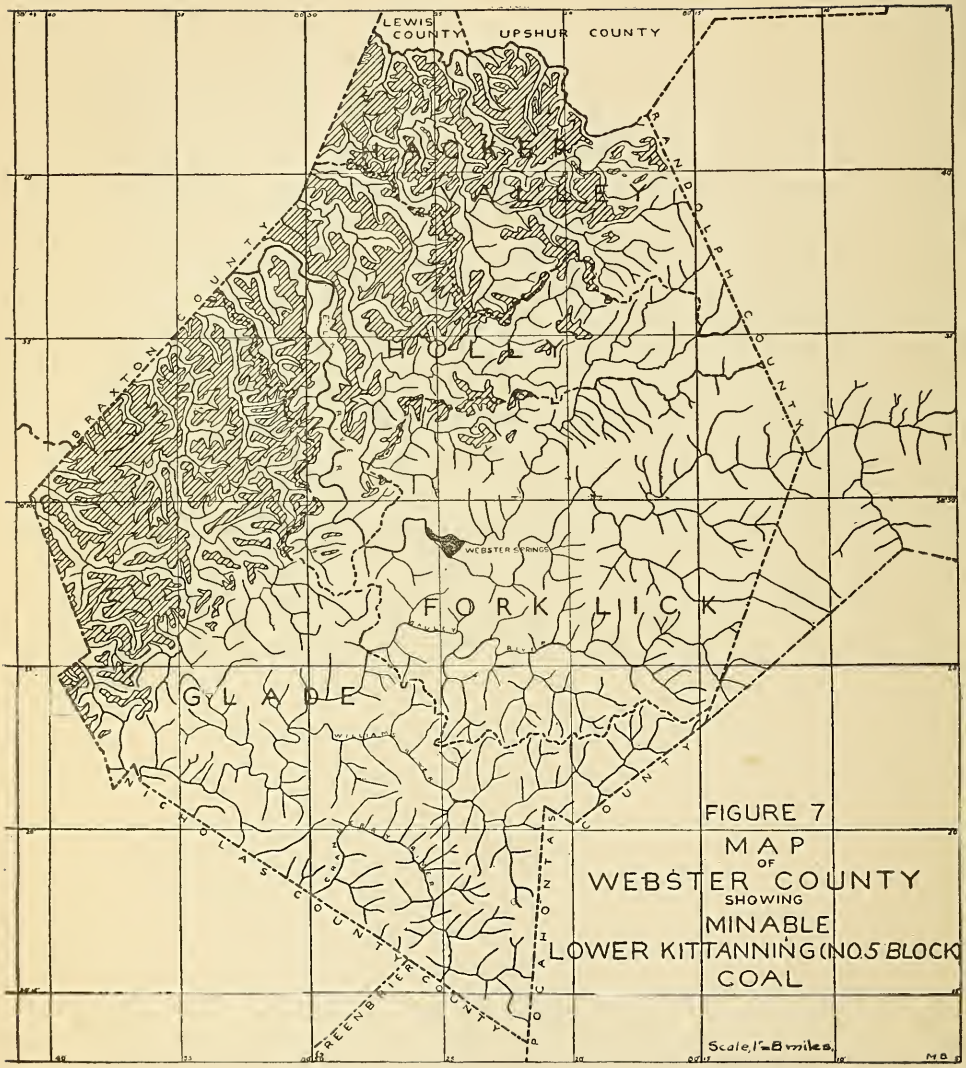


FIGURE 7

MAP OF WEBSTER COUNTY SHOWING MINABLE LOWER KITTANNING (NO. 5 BLOCK) COAL

Lower Kittanning Coal, Hacker Valley District.

In Hacker Valley District, where the rocks dip to the lowest structural level in the county, the Lower Kittanning is found in the ridges of the central and western portions and its horizon is above the hilltops only in the extreme southeastern corner, next to the Randolph line. In the western portion it comes about half-way up the hillsides, making its position very good for mining.

On the waters of Right Fork of Little Kanawha River, the following openings have been noted:

J. A. McCartney Farm Mine—No. 44 on Map II.

On Right Fork of Little Kanawha River, 1.2 miles southeast of Wildcat; **Lower Kittanning Coal**; elevation, 1440′ B.

			Ft.	In.
Slate, black, with plant fossils			2	0
Coal	2′	0″		
Shale, visible	1	0	3	0
Concealed				

At the above opening the lower bench of the coal is evidently concealed, as the full thickness of the seam is not represented.

Robert McCartney Farm Mine—No. 45 on Map II.

On Threelick Run of Little Kanawha River, 1.2 miles northeast of Replete; **Lower Kittanning Coal**; elevation, 1530′ B.

			Ft.	In.
Sandstone, massive, pebbly, **East Lynn**				
Concealed, with **coal blossom**			20	0
Sandstone and shale			5	0
Coal	2′	0″		
Slate	0	6		
Coal, hard	0	6	3	0

At **Prospect No. 46 on Map II**, located on Threelick Run, 0.5 mile eastward from Replete, the coal was once opened at an elevation of 1625′ B., but the place had fallen shut and its thickness was not learned.

Wesley Springer Farm Mine—No. 47 on Map II.

On Threelick Run of Little Kanawha River, 1 mile northeast of Replete; Lower Kittanning Coal; elevation, 1560′ B.

			Ft.	In.
Sandstone, massive, pebbly			75	0
Concealed			35	0
Shale, sandy			5	0
Coal, soft	2′	1″		
Shale, dark-gray, hard	0	3		
Coal, medium-hard	0	10	3	2
Slate, pavement?				

Jesse Robinson Farm Mine—No. 48 on Map II.

On Threelick Run of Little Kanawha River, 1.2 miles northeast of Replete; Lower Kittanning Coal; elevation, 1635′ B.

			Ft.	In.
Coal, visible	1′	6″		
Shale, sandy and concealed	5	0		
Shale, dark	2	0		
Coal, hard, splinty	2	6	11	0
Slate, pavement, and concealed			2	0
Sandstone, massive, Homewood			....	....

W. H. Boggs Farm Mine—No. 49 on Map II.

On Right Fork of Little Kanawha River, 0.5 mile southwest of Boggs; Lower Kittanning Coal; elevation, 1505′ B.

			Ft.	In.
Sandstone, massive, great cliff, pebbly				
Concealed			45	0
Coal, visible	1′	6″		
Slate, dark, hard	2	0		
Coal	0	8		
Slate, black	1	6		
Coal	2	8	8	4
Slate, pavement				

At the **Michael Chipps Farm Mine (No. 50 on Map II)**, located on Williams Camp Run, 0.6 mile southeast of Bois, 2′ 0″ of coal was visible, the lower portion of the seam being concealed by mud, its elevation being 1620′ B.

J. N. Johnson Farm Mine—No. 51 on Map II.

On Williams Camp Run, 1.4 miles southeast of Bois; **Lower Kittanning Coal**; elevation, 1690′ B.

			Ft.	In.
Concealed				
Coal	2′	0″		
Slate, and sandstone	0	6		
Coal, hard, bony splint	0	8		
Slate, bony	1	6		
Coal, visible	0	6	5	2
Concealed by mud.				

James Baker Farm Mine—No. 52 on Map II.

On Right Fork of Little Kanawha River, 0.7 mile eastward from Bois; **Lower Kittanning Coal**; elevation, 1580′ B.

			Ft.	In.
Slate, black			1	0
Coal	2′	6″		
Slate, black, bony	1	10		
Coal	0	9		
Slate, black	0	1		
Coal	0	5		
Slate, black, bony	0	3		
Coal	1	6	7	4
Slate, pavement				

Frank Life Farm Mine—No. 53 on Map II.

On a short branch of Little Kanawha River, 1.3 miles southward from Cleveland; **Lower Kittanning Coal**; elevation, 1835′ B.

			Ft.	In.
Sandstone, massive				
Coal, medium-hard	1′	11″		
Slate, black	0	4		
Coal, splinty	1	4	3	7
Slate, pavement				

At **Prospect No. 54 on Map II**, located on Jerry Run, 2.5 miles southward from Cleveland, the coal was once opened at an elevation of 1960′ B., but its thickness was not learned.

At the **Alexander Anderson Prospect (No. 55 on Map II)**, on Jerry Run, 2.4 miles northeast of Hacker Valley, the coal was once opened at an elevation of 2180′ B., but had fallen shut, the seam being reported thin by Mr. Anderson.

On the head of the Left Fork of Buffalo Run of Little Kanawha River, the coal was once opened at the **Martin Harper Prospect** (No. 56 on Map II), 2.3 miles southeast of Cleveland, at an elevation of 2080′ B., but had fallen shut, its thickness being reported as 2′ 6″ by Mr. Harper.

Cooper Wilson Farm Mine—No. 57 on Map II.

On Right Fork of Little Kanawha River, 2.2 miles southeast of Cleveland; **Lower Kittanning Coal**; elevation, 2020′ B.

		Ft.	In.
Shale, dark			
Coal	0′ 4″		
Shale, gray	1 6		
Coal	1 3		
Slate, black	0 10		
Coal	3 0		
Slate, dark, reported	0 10		
Coal, reported	4 0		
Slate, reported	0′ 10″ to 1 0		
Coal, soft, reported	2 4		
Coal, gray splint, reported	1 8	16	9
Sandstone, massive			

At the above opening only the upper portion was visible, the lower benches being reported by the owner.

George Bender Farm Mine—No. 58 on Map II.

On Long Run of Little Kanawha River, 3.1 miles southeast of Cleveland; **Lower Kittanning Coal**; elevation, 2105′ B.

		Ft.	In.
Slate, dark		1	0
Coal	0′ 10″		
Coal, bony	0 6		
Coal	1 3		
Slate, black	0 2		
Coal	1 0	3	9
Slate			

The following opening was noted by D. D. Teets, Jr., near the common corner of Webster, Upshur, and Randolph Counties:

D. S. Thomas Farm Mine—No. 59 on Map II.

On the head of Right Fork of Little Kanawha River, 1 mile southwest of Arvondale Junction; **Lower Kittanning Coal**; elevation, 2730′ B.

			Ft.	In.
Slate, black			2	0
Coal, soft	1′	3″		
Bone	2	3		
Coal, soft	3	0	6	6
Slate, pavement				

On the Left Fork of Holly River, the following openings were noted:

A. Shreve Farm Mine—No. 60 on Map II.

On Left Fork of Holly River, 0.6 mile southwest of Replete; **Lower Kittanning Coal**; elevation, 1650′ B.

			Ft.	In.
Slate, dark			0	6
Coal	0′	11″		
Slate, black	0	3		
Coal	1	7	2	9
Slate, pavement				

Elza Simmons Farm Mine—No. 61 on Map II.

On the head of Long Run of Left Fork of Holly River, 1.2 miles northwest of Pugh; **Lower Kittanning Coal**; elevation, 1875′ B.

			Ft.	In.
Slate, black				
Coal	2′	0″		
Slate, black, bony	0	4		
Coal	1	1		
Slate, black	0	3		
Coal, splinty	0	8	4	4
Slate, pavement				

William Cowger Farm Mine—No. 62 on Map II.

On Long Run of Left Fork of Holly, 1.3 miles southwest of Pugh; **Lower Kittanning Coal**; elevation, 2000′ B.

			Ft.	In.
Slate, black, with streaks of coal			3	0
Coal, medium-hard	1′	10″		
Slate, black, bony	0	5		
Coal, medium-hard	2	4	4	7
Slate, pavement				

S. Jordan Farm Mine—No. 63 on Map II.

On Potts Run of Left Fork of Holly, 1.8 miles southeast of Poling; Lower Kittanning Coal; elevation, 1835′ B.

			Ft.	In.
Slate, black				
Coal, medium-soft	1′	0″		
Slate, black, bony	0	4		
Coal, medium-hard	2	0	3	4
Slate, pavement				

Howard Anderson Farm Mine—No. 64 on Map II.

On Left Fork of Holly River, 1.1 miles southeast of Poling; Lower Kittanning Coal; elevation, 1815′ B.

			Ft.	In.
Slate, dark				
Coal, soft	0′	10″		
Slate, bony	0	8		
Coal, medium-hard	2	11		
Slate, dark	0	2		
Coal, semi-splint	0	10	5	5
Slate, pavement				

Lee Casto Farm Mine—No. 65 on Map II.

On the ridge between Radabaugh and Williams Camp Runs, 1.4 miles northeast of Poling; Lower Kittanning Coal; elevation, 1759′ L.

			Ft.	In.
Concealed and black shale				
Coal	1′	6″		
Shale, dark	4	0		
Coal, soft	1	0		
Slate, black	0	2		
Coal, splinty	2	11		
Slate, black	0	3		
Coal, hard, splinty	1	1	10	11
Slate, pavement				

The coal was once opened at the **Charles Marple Farm Mine** (No. 66 on Map II), on Radabaugh Run, 1.6 miles northeast of Poling, at an elevation of 1815′ B., but had fallen shut and its thickness was not learned.

D. J. Casto Farm Mine—No. 67 on Map II.

On Radabaugh Run, 1.8 miles northeast of Poling; **Lower Kittanning Coal**; elevation, 1770′ B.

			Ft.	In.
Sandstone, massive				
Coal, medium-soft	2′	1″		
Slate, black, bony	0	3		
Coal, medium-hard	1	5		
Slate, dark, bony	1	10		
Coal, semi-splint	2	10		
Slate, dark	0	5		
Coal, semi-splint	1	10	10	8
Slate, pavement				

The **Lloyd Anderson Farm Mine (No. 68 on Map II)**, on Left Fork of Holly River, 0.5 mile northwest of Wheeler, measured 6′ 7″, with partings, as exhibited in the section for Wheeler, page 74, its elevation being 1855′ L.

John Ware Farm Mine—No. 69 on Map II.

On a short branch of Left Fork of Holly River, 0.8 mile southwest of Wheeler; **Lower Kittanning Coal**; elevation, 1855′ B.

			Ft.	In.
1. Slate, black				
2. **Coal**, soft	0′	4″		
3. **Coal**, hard, splinty	2	7		
4. Slate, black, bony	0	8		
5. **Coal**, splinty	1	6	5	1
6. Slate, pavemennt				

A sample (No. 169R) was collected from Nos. 2, 3, and 5 of section, the composition of which is published under **Mine No. 69** in the Survey Table of Coal Analyses at the end of this Chapter.

John Ware Farm Mine—No. 70 on Map II.

On Potts Run of Left Fork of Holly River, 1 mile southwest of Wheeler; **Lower Kittanning Coal**; elevation, 1835′ B.

			Ft.	In.
Shale, sandy				
Coal, splinty	1′	4″		
Slate, black, hard	0	2		
Coal, splinty	1	2		
Slate, black, bony	0	4		
Coal, hard	0	11	3	11
Slate, pavement				

J. A. Hinkle Farm Mine—No. 71 on Map II.

On Left Fork of Holly River, 0.4 mile eastward from Wheeler; **Lower Kittanning Coal**; elevation, 1880′ B.

			Ft.	In.
Shale, sandy			7	0
Coal, bony	0′	3″		
Coal, semi-splint	2	5		
Slate, black, bony	0	5		
Coal, semi-splint	1	7	4	8
Slate, pavement				

A sample (No. 24) was collected from this mine by D. D. Teets, Jr., the composition of which is published under **Mine No. 71** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Francis Arbogast Farm Mine—No. 72 on Map II.

On Left Fork of Holly River, 0.8 mile southeast of Wheeler; **Lower Kittanning Coal**; elevation, 1940′ B.

			Ft.	In.
Sandstone, massive				
Coal, semi-splint	2′	10″		
Slate, black, soft	0	5		
Coal, hard, bony	0	8		
Coal, semi-splint	1	2	5	1
Slate, pavement				

Clarence McCartney Farm Mine—No. 73 on Map II.

On Left Fork of Holly River, 0.9 mile southeast of Wheeler; **Lower Kittanning Coal**; elevation, 1940′ B.

			Ft.	In.
Sandstone, massive				
Coal, semi-splint	2′	2″		
Slate, black	0	5		
Coal, hard, bony	0	5		
Coal, semi-splint	1	8	4	8
Slate, pavement				

PLATE XX.—Clifton Trestle along West Virginia Midland Railroad near Water Station; Topography of Allegheny and Pottsville Series.

Daniel Anderson Farm Mine—No. 74 on Map II.

On Left Fork of Holly River, 0.7 mile northeast of Pugh; **Lower Kittanning Coal**; elevation, 1975′ B.

			Ft.	In.
Concealed and coal blossom				
Sandstone, massive			2	0
Coal, splinty	2′	7″		
Slate, black, bony	0	7		
Coal, splinty	1	7	4	9
Slate, pavement				

The **A. W. Anderson Farm Mine (No. 75 on Map II)**, located on the head of Long Run of Left Fork of Holly, 0.5 mile northwest of Pugh, at an elevation of 1950′ B., had fallen shut, but the coal was reported 6 to 7 feet thick.

The **George Brake Farm Mine (No. 76 on Map II)**, located on the head of Long Run, 0.5 mile northwest of Pugh, measured 6′ 3″, with partings, as exhibited in the section for Pugh, page 75, its elevation being 1950′ B.

On Hodam Creek the coal was once opened at the **Everett Hamrick Prospect (No. 77 on Map II)**, located 0.5 mile westward from Hodam village, but had fallen shut, its elevation being 2415′ B., and its thickness reported as 4 feet.

On the head of Hodam Creek the coal was once opened at **Prospect No. 78 on Map II**, located 1.7 miles southwest of Hodam village, at an elevation of 2445′ B., but had fallen shut its thickness not being learned.

J. W. McClure Prospect—No. 79 on Map II.

On the head of Hodam Creek, 1.4 miles southeast of Hodam village; **Lower Kittanning Coal**; elevation, 2440′ B.

			Ft.	In.
Sandstone, massive				
Coal, hard, with bony splint	2′	6″		
Slate, bony	0	11		
Coal, hard, splinty	1	6	4	11
Sandstone, massive				

Several prospects have been made along the Laurel Fork of Left Fork of Holly, the following having been noted:

Lewis Cogar Farm Mine—No. 80 on Map II.

On Laurel Fork of Left Fork of Holly, 2.1 miles eastward from Hacker Valley; **Lower Kittanning Coal**; elevation, 2280′ B.

			Ft.	In.
Concealed and coal blossom				
Coal	1′	0″		
Slate, dark	4	0		
Coal, main bench, mostly concealed by water, may be	3	0	8	0

Jacob Gobeli Farm Mine—No. 81 on Map II.

On a branch of Laurel Fork of Left Fork of Holly, 1.9 miles westward from Penbro; **Lower Kittanning Coal**; elevation, 2445′ B.

			Ft.	In.
1. Sandstone, massive				
2. **Coal**	0′	7″		
3. Slate, bony	0	3		
4. **Coal**, medium-hard	4	3	5	1
5. Slate and concealed to pebbly sandstone, **Homewood**			10	0

A sample (No. 167R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 81** in the Survey Table of Coal Analyses at the end of this Chapter.

The coal was once opened at **Prospect No. 82 on Map II,** on Left Fork of Holly River, 1.5 miles east of Hacker Valley, at an elevation of 2210′ B., but had fallen shut and its thickness was not learned.

At the **Samuel Grimes Prospect (No. 83 on Map II)**, on Left Fork of Holly, 2.6 miles eastward from Hacker Valley, the coal was only partly exposed, 2 feet being visible at an elevation of 2320′ B.

Elihu Vance Heirs Farm Mine—No. 84 on Map II.

On Left Fork of Holly River, 2.4 miles eastward from Hacker Valley; **Lower Kittanning Coal**; elevation, 2370′ B.

			Ft.	In.
Sandstone, massive				
Coal, medium-hard	1′	3″		
Coal, hard, bony	0	7		
Coal, medium-soft	2	9	4	7
Slate, pavement, and concealed to **Homewood Sandstone**			10	0

John Anderson Farm Mine—No. 85 on Map II.

On Johns Run of Left Fork of Holly River, 3.1 miles southeast of Hacker Valley; **Lower Kittanning Coal**; elevation, 2375′ B.

			Ft.	In.
Slate, dark, sandy			5	0
Coal, hard	1′	5″		
Coal, hard, bony splint	0	4		
Coal, soft, columnar	0	7		
Coal, hard, splinty	0	8		
Slate, bony	0	8		
Coal, hard, splinty	1	6	5	2
Slate, pavement				

Henry Anderson Farm Mine—No. 86 on Map II.

On Left Fork of Holly River, 2.9 miles southeast of Hacker Valley; **Lower Kittanning Coal**; elevation, 2345′ B.

			Ft.	In.
Shale, dark			4	0
Coal, medium-hard	2′	10″		
Slate, bony	0	7		
Coal, splinty	0	10	4	3
Slate, pavement				

Dr. J. L. Cunningham Farm Mine (Allen Anderson Opening) —No. 87 on Map II.

On Fall Run of Left Fork of Holly River, 1.6 miles southwest of Penbro; **Lower Kittanning Coal**; elevation, 2610′ B.

			Ft.	In.
Sandstone, massive				
Shale, dark, sandy			2	0
Coal, semi-splint	2′	5″		
Slate, bony	0	3		
Coal, semi-splint	3	8	6	4
Slate, pavement				

The coal was once opened at **Prospect No. 88 on Map II**, on Fall Run of Left Fork of Holly River, 1.4 miles southwest of Penbro, at an elevation of 2640′ B., but had fallen shut and its thickness was not obtained.

The **Howard Arbogast Farm Mine (No. 89 on Map II)**, located on Big Run of Left Fork of Holly, 1.1 miles south of the mouth of the branch and 4.5 miles southeast of Hacker Valley, had fallen shut but was reported as a big thick seam by Mr. Arbogast, there being several slate partings.

Lower Kittanning Coal, Holly District.

In Holly District the Lower Kittanning is present in the ridges in the central and western portion but in the eastern end, next to the Randolph County Line, it is above the top of the hills. It has been prospected and mined for local fuel at various points, as the following openings show:

W. G. Bennett Farm Mine—No. 90 on Map II.

On Oldlick Creek, 2.6 miles southwest of Hodam; **Lower Kittanning Coal**; elevation, 2410′ B.

			Ft.	In.
Sandstone, massive				
Coal	2′	5″		
Shale, gray	2	2		
Coal	1	4	5	11
Slate, pavement				

Pardee and Curtin Lumber Company Prospect—No. 91 on Map II.

On Grassy Creek, 0.8 mile northward from Summit Station; **Lower Kittanning Coal**; elevation, 2110′ B.

			Ft.	In.
Shale, sandy				
Coal, soft	1′	8″		
Coal, hard or bony	0	9		
Coal, soft	1	2	3	7
Concealed			5	0
Sandstone, massive, **Homewood**			60	0

A sample (No. 234R) was collected from Nos. 2, 3, and 4 of section, the composition of which is published under **Mine No. 91** in the Survey Table of Coal Analyses at the end of this Chapter.

Edwin Ware Farm Mine—No. 92 on Map II.

On Right Fork of Holly River, 1.2 miles southeast of Jumbo; **Lower Kittanning Coal**; elevation, 2260′ B.

			Ft.	In.
Shale, dark				
Coal, soft	1′	4″		
Shale, gray	1	0		
Coal, medium-soft	2	2		
Coal, bony	0	5		
Coal, hard, splinty	1	8	6	7
Slate, pavement				

The **M. P. Brooks Farm Mine (No. 93 on Map II)**, located on Right Fork of Holly opposite the mouth of Laurel Fork and 2.2 miles southeast of Jumbo, had fallen shut, its thickness being reported as 4′ 2″ by Mr. Brooks, as exhibited in the section for Laurel Fork of Holly, page 85, its elevation being 2420′ B.

At the following prospect the coal is only partly opened:

Coal Prospect—No. 94 on Map II.

On Laurel Fork of Right Fork of Holly, 1.7 miles northward from Skelt; **Lower Kittanning Coal**; elevation, 2625′ B.

			Ft.	In.
Shale, gray			0	4
Coal	0′	4″		
Shale, gray	1	6		
Coal, medium-soft	1	2	3	0
Coal, bony, not taken up, thickness unknown				

On the waters of Elk River a few openings have been made in Holly District, the following having been noted:

The **Dr. J. M. Brockerhoff Prospect (No. 95 on Map II)**, located on Houston Run of Elk River, 2.5 miles southeast of Centralia, at an elevation of 1845′ B., measured 2′ 6″, as exhibited in the section for Houston Run, page 91.

Ross F. Stout Farm Mine—No. 96 on Map II.

On Big Run of Elk River, 1 mile east of Arcola; **Lower Kittanning Coal**; elevation, 2485′ B.

			Ft.	In.
Sandstone, massive			5	0
Coal, hard, splinty	3′	0″		
Coal, bony	2	0		
Coal, hard, splinty	2	4	7	4
Slate, pavement				

The coal was once opened at **Prospect No. 97 on Map II**, located along the ridge road at the head of Big Run of Elk, 1 mile eastward from Jack, at an elevation of 2595′ B., but had fallen shut, its thickness not being learned.

W. B. Tracy Prospect—No. 98 on Map II.

On the south side of Elk River, 1.2 miles southwest of Tracy Switch; **Lower Kittanning Coal**; elevation, 2475′ B.

	Ft.	In.
Concealed and slate from Middle Kittanning Coal..	11	0
Coal	3	0
Coal, thickness concealed by water		

Lower Kittanning Coal, Fork Lick District.

In Fork Lick District, the Lower Kittanning is found only in the extreme northwestern corner, its horizon elsewhere being above the tops of the mountains. The following openings were noted:

William Fisher Prospect—No. 99 on Map II.

On Big Run of Grassy Creek, on the southwest slope of the Cool Spring Knob, 0.8 mile northward from Orndoff; **Lower Kittanning Coal**; elevation, 2460′ B.

			Ft.	In.
Slate, black				
Coal, soft	0′	9″		
Slate, dark	0	6		
Coal, soft	4	8		
Coal, bony	1	2		
Coal, medium-hard	2	0	9	1
Slate, pavement?				

The **P. F. Gregory Farm Mine (No. 100 on Map II)**, located on a short branch of Grassy Creek, 0.6 mile southwest of Kovan, at an elevation of 2465′ B., had fallen shut but was reported 5 feet thick, with a slate parting.

The **Levi Miller Farm Mine (No. 101 on Map II)**, located on a short branch of Grassy Creek, 0.9 mile northwest of Kovan, at an elevation of 2355′ B., had fallen shut, being reported 5 to 8 feet thick.

Lower Kittanning Coal, Glade District.

In Glade District the Lower Kittanning is present in the ridges of the northwestern portion, next to Braxton and Nicholas Counties, but in the central and southeastern part, next to Pocahontas and Greenbrier, its horizon is entirely above the

tops of the mountains. The following openings were observed, starting first with those on the waters of Laurel Creek of Elk River:

Stalnaker and Hines Prospect—No. 102 on Map II.

On Upper Laurel Fork of Camp Creek, 3.9 miles northeast of Erbacon; Lower Kittanning Coal; elevation, 2165′ B.

			Ft.	In.
Slate, black				
Coal, slaty at top, about	2′	6″		
Slate, gray, about	1	3		
Coal, reported	2	4	6	1
Slate, pavement				

The above prospect was half filled with water, the thicknesses being estimated by eye.

The following prospect was noted by D. D. Teets, Jr.:

J. S. Hyer Heirs Prospect—No. 103 on Map II.

On Laurel Creek, just east of Prestonia; Lower Kittanning Coal; elevation, 1525′ B.

			Ft.	In.
Sandstone, visible			20	0
Shale, slaty, dark			5	0
Coal, bony	1′	0″		
Slate, gray	1	0		
Coal, medium-hard	1	0		
Slate, gray	0	6		
Coal, soft	0	5		
Slate, gray	0	11		
Coal, good	3	0	7	10
Shale, gray, pavement				

The following opening has recently been made in the edge of Holly District, Braxton County, the coal being used for engine fuel on the narrow-gauge railroad of the Brooks Run Lumber Company:

Brooks Run Lumber Company Mine—No. 104 on Map II.

On Brooks Creek, 0.9 mile southwest of Prestonia; **Lower Kittanning Coal**; elevation, 1485′ B.

			Ft.	In.
Slate, dark				
Coal	0′	3″		
Slate, dark	0	6		
Coal, soft	0	10		
Coal, splinty	1	5		
Coal, soft	0	10		
Slate	0″ to	0 1		
Coal	0	6	4	5
Slate, pavement				

Jackson Farm Mine—No. 105 on Map II.

On Brooks Creek, 2.1 miles southward from Prestonia; **Lower Kittanning Coal**; elevation, 1675′ B.

			Ft.	In.
Coal blossom				
Shale, sandy			4	0
Coal, medium-hard	2′	2″		
Coal, soft	2	0	4	2
Slate, pavement				

A sample (No. 29) was collected from this mine by D. D. Teets, Jr., the composition of which is published under **Mine No. 105** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Floyd Harris Farm Mine—No. 106 on Map II.

On Brooks Creek, 2.3 miles southward from Prestonia; **Lower Kittanning Coal**; elevation, 1690′ B.

			Ft.	In.
Slate, black, with streaks of coal			4	0
Coal, soft	1′	5″		
Shale, gray	1	3		
Coal, splinty	2	11		
Coal, soft	0	8	6	3
Slate, pavement				

A sample (No. 30) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 106** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

S. H. Kelly Prospect—No. 107 on Map II.

On Laurel Creek, 1.2 miles northward from Defoe; **Lower Kittanning Coal**; elevation, 1690′ B.

			Ft.	In.
Shale, dark				
Coal	0′	6″		
Slate, dark	0	5		
Coal	1	11		
Slate, gray	0	2		
Coal	0	5		
Slate, gray	0	5		
Coal	0	4	4	2
Slate, pavement				

The following opening was noted by Ray V. Hennen:

Ross F. Stout Prospect—No. 108 on Map II.

On a short branch of Laurel Creek, 0.5 mile northwest of Defoe; **Lower Kittanning Coal**; elevation, 1725′ B.

			Ft.	In.
Concealed				
Coal	0′	4″		
Shale, gray	0	7		
Coal	0	7		
Shale, gray	0	5		
Coal, medium-soft	1	6		
Shale, black	0	4		
Coal, soft	0	3		
Coal, splint, hard	0	11		
Coal, softer	2	0		
Shale, gray	0	4		
Coal, medium-hard	0	7	7	10
Slate, gray, pavement				

A sample (No. 31) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 108** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

B. W. Clifton Farm Mine—No. 109 on Map II.

On Whiteoak Run of Laurel Creek, 0.7 mile southeast of Defoe; **Lower Kittanning Coal**; elevation, 1920′ B.

			Ft.	In.
Sandstone, massive, cliff			30	0
Concealed			30	0
Coal blossom, reported				
Slate, dark			0	10
Coal, soft	1′	8″		
Shale, gray	1	4		
Coal, hard	2	1	5	1
Slate, pavement				

The **A. F. Scott Prospect** (No. 110 on Map II), located on Whiteoak Run of Laurel Creek, 1.5 miles southeast of Defoe, had fallen shut, its thickness being reported as 2′ 11″.

A. F. Scott Farm Mine—No. 111 on Map II.

On Laurel Creek, 0.9 mile northeast of Erbacon; **Lower Kittanning Coal**; elevation, 1970′ B.

			Ft.	In.
Slate, dark			3	0
Slate, black, cannel			0	5
Shale, dark-gray			0	8
Coal, soft	1′	0″		
Slate, dark	0	2		
Coal, soft	0	8		
Shale, gray	0	6		
Coal, medium-hard	2	0	4	4
Slate, pavement				

William R. Holcomb Farm Mine—No. 112 on Map II.

On Carpenter Fork of Laurel Creek, 0.7 mile eastward from Erbacon; **Lower Kittanning Coal**; elevation, 2045′ B.

			Ft.	In.
Sandstone, massive				
Shale, sandy			5	0
Coal	1′	9″		
Slate, cannel	0	5		
Slate, dark	0	9		
Coal, slaty	1	3		
Coal	1	0		
Slate	0	2		
Coal	0	5		
Slate	0	1		
Coal, hard	3	3	9	1
Slate, pavement				

The **Thomas Johns Farm Mine** (No. 113 on Map II), located on Laurel Creek, 0.5 mile south of Erbacon, at an elevation of 2055′ B., measured 6′ 2″ thick, with partings, as exhibited in the section for Erbacon, page 108. Since field work was completed a commercial mine has been put into operation at this opening by the **Wythe Block Coal Company**, of Erbacon.

At **Exposure No. 114 on Map II**, the blossom of the coal was observed against the steep mountainside on Laurel Creek, 0.6 mile northwest of Wainville, its elevation being 2116′ B.

On Amos Run of Laurel Creek the coal has been opened at the **Stalnaker and Hines Prospect (No. 115 on Map II)**, located 2.9 miles northeast of Wainville, at an elevation of 2295′ B., but the place had fallen shut and could not be measured, being reported 4 feet thick by residents of the community.

On Denison Run of Laurel Creek the blossom of the coal was noted at **Exposure No. 116 on Map II**, near the top of a knob, 2.3 miles northeast ot Cowen, its elevation being 2680′ B.

On the waters of Birch River several openings have been made, the following having been noted:

Davis-Eakin Lumber Company Mine (Black Betsey Coal Company Land)—No. 117 on Map II.

On Road Fork of Skyles Creek, 2.6 miles northeast of Skyles; Lower Kittanning Coal; elevation, 1965′ B.

			Ft.	In.
1.	Slate, black			
2.	Coal, slaty, roof	2′ 6″		
3.	Coal, hard, splinty	1 0½		
4.	Bone	0 2		
5.	Coal	0 1½		
6.	Bone	0 3		
7.	Coal, hard	1 2		
8.	Coal, soft	1 2	6	5
9.	Slate, pavement			

A sample (No. 189R) was collected from Nos. 3, 7, and 8 of section, the composition of which is published under **Mine No. 117** in the Survey Table of Coal Analyses at the end of this Chapter. Coal from this mine is used for engine fuel on the standard-gauge logging railroad of the operating company.

Black Betsey Coal Company Prospect—No. 118 on Map II.

On the head of Skyles Creek, 1.3 miles northward from Boggs; Lower Kittanning Coal; elevation, 2060′ B.

			Ft.	In.
Sandstone, shaly, with coal spars			10	0
Shale, dark			5	0
Coal, soft	0′	6″		
Coal, medium-hard	1	5		
Shale, dark	0	10		
Coal, medium-soft	2	4	5	1
Slate, pavement				

Tioga Lumber Company Prospect (Margaret Strange Opening)—No. 119 on Map II.

On a branch of Barnet Run of Birch River, 1.1 miles southwest of Boggs; Lower Kittanning Coal; elevation, 2180′ B.

			Ft.	In.
1. Slate, black				
2. Coal, slaty	3′	0″		
3. Coal, splinty	1	2		
4. Bone	0	2		
5. Coal, splinty	2	3	6	7
6. Shale, gray, pavement				

A sample (No. 1P) was collected from Nos. 3 and 5 of section by Dr. W. A. Price the composition of which is published under Mine No. 119 in the Survey Table of Coal Analyses at the end of this Chapter.

Tioga Lumber Company Prospect—No. 120 on Map II.

On Barnet Run of Birch River, 1.8 miles southwest of Boggs; Lower Kittanning Coal; elevation, 2286′ L.

			Ft.	In.
Slate, bony				
Coal, hard, splinty	0′	11″		
Bone	0	1		
Coal	0	3		
Bone	0	4		
Coal, splinty	2	5	4	0
Slate, pavement				

The Black Betsey Coal Company Prospect (No. 121 on Map II), located on Birch River, 1.2 miles northeast of Boggs, along the road leading toward Erbacon, measured 6′ 9″ of

clean coal, as exhibited in the section for Boggs, page 111, its elevation being 2205′ B.

The **Black Betsey Coal Company Prospect (Luther Boggs Opening—No. 122 on Map II)**, located on Laurel Run of Birch River, 1.4 miles eastward from Boggs, at an elevation of 2225′ B., measured 7 feet of rotten coal, the opening not being driven far enough under cover to distinguish slaty or bony coal.

Farther up Birch River the following exposure was noted in a ravine:

Coal Exposure—No. 123 on Map II.

On Otterhole Run of Birch River, 2.3 miles southeast of Boggs; **Lower Kittanning Coal**; elevation, 2325′ B.

			Ft.	In.
Shale				
Coal	0′	4″		
Shale, gray	0	4		
Coal, splinty	1	7		
Shale, gray	0	8		
Coal	0	10	3	9
Shale, gray, pavement				

Keystone Lumber and Mining Company Prospect—No. 124 on Map II.

On a branch of Jacks Run of Birch River, 2.9 miles northwest of Cowen; **Lower Kittanning Coal**; elevation, 2440′ B.

			Ft.	In.
Slate, from Middle Kittanning Coal			2	0
Coal	0′	10″		
Slate, bony	0	7		
Coal, splinty	1	0		
Shale, dark	0	9		
Coal, soft	2	2	5	4
Slate, pavement				

Keystone Lumber and Mining Company Prospect—No. 125 on Map II.

On Jacks Run of Birch River, 3.1 miles northwest of Cowen; **Lower Kittanning Coal**; elevation, 2425′ B.

			Ft.	In.
Coal, visible	0′	4″		
Slate, bony	0	7		
Coal, hard, splinty	1	0		
Slate, dark	0	6		
Coal, hard, splinty	1	4	3	9
Slate, pavement				

On the headwaters of Beaver Creek several prospects have been made, the following having been noted:

The **Tioga Lumber Company Prospect (No. 125A on Map II)**, located on Beaver Creek, 1.4 miles northeast of Tioga, had partly fallen shut, 3 feet of coal being visible at an elevation of 2318′ L.

Tioga Lumber Company Prospect—No. 126 on Map II.

On O'Brien Fork of Beaver Creek, 1.7 miles northeast of Tioga; **Lower Kittanning Coal**; elevation, 2339′ L.

			Ft.	In.
Concealed and slate from Middle Kittanning Coal			5	9
Coal, reported	0′	10 ″		
Concealed and black slate	2	0		
Coal, slaty and bony	3	9		
Coal, hard, splinty	1	0½		
Bone	0	0½		
Coal	0	4		
Bone	0	3		
Coal, hard, splinty	2	0	10	3
Slate, pavement				

Coal Prospect—No. 127 on Map II.

On O'Brien Fork of Beaver Creek, 1 mile southward from Boggs; **Lower Kittanning Coal**; elevation, 2310′ B.

			Ft.	In.
Slate				
Coal, slaty	1′	6″		
Coal, soft	1	7		
Shale, gray	0	2		
Coal, hard, visible	2	0	5	3
Concealed				

Black Betsey Coal Company Prospect—No. 128 on Map II.

On O'Brien Fork of Beaver Creek, 1 mile southeast of Boggs; **Lower Kittanning Coal**; elevation, 2300′ B.

			Ft.	In.
Slate				
Coal, slaty	2′	6″		
Coal, medium-soft	4	2	6	8
Slate, pavement				

Henry Norman Farm Mine—No. 129 on Map II.

On O'Brien Fork of Beaver Creek, 1.2 miles southeast of Boggs; **Lower Kittanning Coal**; elevation, 2315′ B.

			Ft.	In.
1. Slate, black				
2. **Coal**	0′	7″		
3. Slate, black	0	7		
4. **Coal**, bony	1	7		
5. Slate, sandy	0	3		
6. **Coal**, slightly bony	1	9		
7. Slate, black	0	2		
8. **Coal**, splint	3	5	8	4
9. Slate, pavement				

A sample (No. 243R) was collected from No. 8 of section, the composition of which is published under **Mine No. 129** in the Survey Table of Coal Analyses at the end of this Chapter. A sample was once collected from this opening by James W. Paul, formerly State Mine Inspector of West Virginia, apparently from Nos. 4, 6 and 8 of section, the composition of which, as furnished the Survey by George F. Duck, of Clearfield, Pa., is as follows:

	Per cent.
Moisture	1.46
Volatile Matter	29.10
Fixed Carbon	50.38
Ash	19.06
Total	100.00
Sulphur	0.92

On Oldhe Fork of Beaver, 2.1 miles northeast of Tioga, the coal was once opened at **Prospect No. 130 on Map II**, at an elevation of 2380′ B., but its thickness was not learned, the opening having fallen shut.

Tioga Lumber Company Prospect (Richard Hammond Opening)—No. 131 on Map II.

On Oldhe Fork of Beaver Creek, 1.7 miles northeast of Tioga; **Lower Kittanning Coal**; elevation, 2390′ B.

			Ft.	In.
Slate, black, cannelly			2	6
Coal	1′	9″		
Shale, gray	1	0		
Coal, hard, splinty	2	2	4	11
Slate, pavement				

Black Betsey Coal Company Prospect (Jasper Ferris Opening) —No. 132 on Map II.

On the head of Oldhe Fork of Beaver Creek, 2.7 miles eastward from Tioga; Lower Kittanning Coal; elevation, 2540′ B.

			Ft.	In.
Slate				
Coal, slaty	2′	0″		
Coal, soft	1	2		
Slate, dark	0	2		
Coal	1	3		
Slate, black	0	2		
Coal, splinty	2	8	7	5
Slate, pavement				

A few openings have been made on the headwaters of Strouds Creek where the coal is high in the hills, the following having been noted:

Brooks Baber Farm Mine—No. 133 on Map II.

On the head of Strouds Creek, 1.1 miles southeast of Tioga; Lower Kittanning Coal; elevation, 2485′ B.

			Ft.	In.
Shale, dark, with coal streaks			5	0
Coal			0	3
Shale, dark			3	0
Slate, black, cannel			1	0
Coal, slaty	1′	10″		
Coal, medium-hard	1	0		
Shale, gray	0	3		
Coal, medium-hard, with bony streaks	3	1	6	2
Slate, pavement				

Jacob Hayhurst Farm Mine—No. 134 on Map II.

On Strouds Creek, 1.4 miles southeast of Tioga; Lower Kittanning Coal; elevation, 2535′ B.

			Ft.	In.
Coal blossom				
Slate, black			0	10
Coal, soft	1′	0″		
Slate, black, cannelly	2	3		
Coal, slaty	1	2		
Slate, dark	0	2		
Coal, hard, splinty	0	11		
Bone	0	1		
Coal	0	7		
Bone	0	2		
Coal, hard, splinty	2	1	8	5
Slate, pavement				

PLATE XXI.—Holly Mountain, looking up Grassy Creek from Diana.

Quantity Lower Kittanning Coal Available.

The following table, compiled by Miss Buchanan from a planimetric measurement of the outcrop of the coal on Map II, shows the probable amount of Lower Kittanning Coal by districts in the county:

Probable Amount of Lower Kittanning Coal.

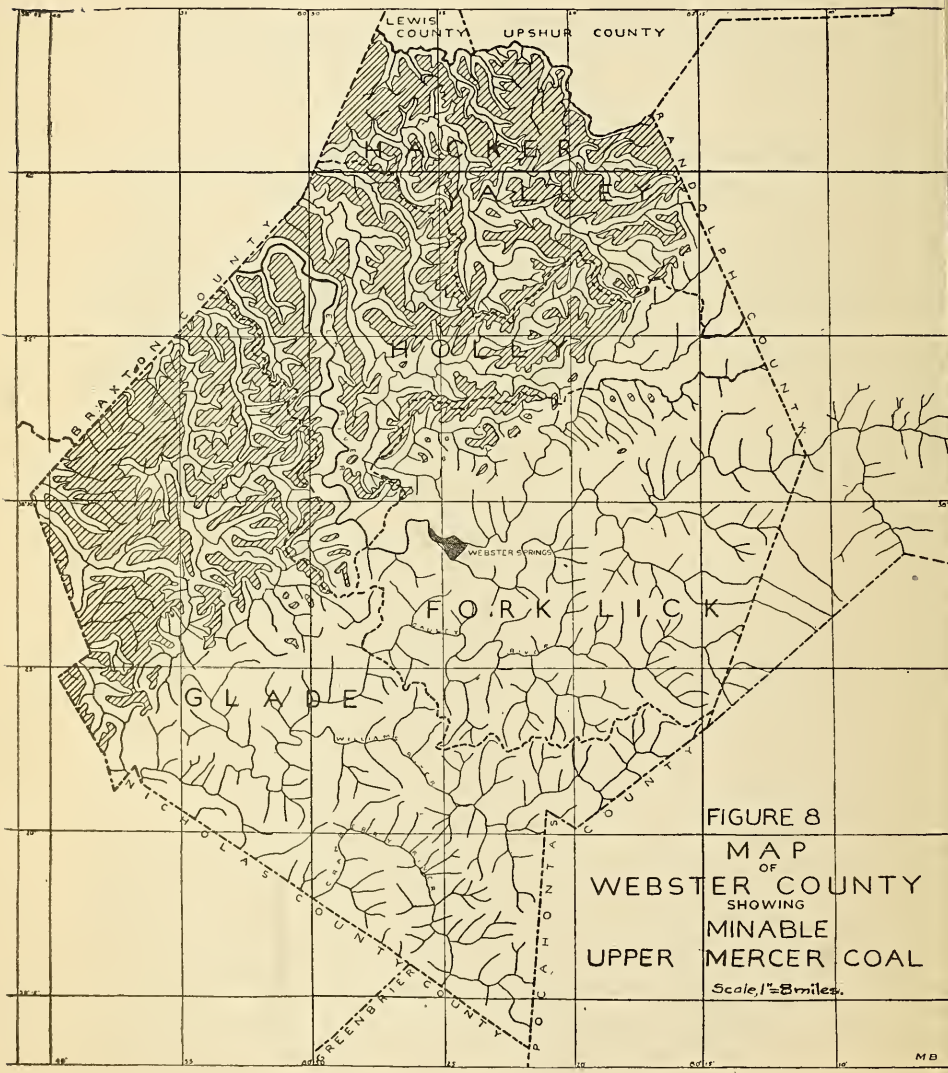
Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	5	25.85	16,544	3,603,283,200	144,131,328
Holly	5	22.30	14,272	3,108,441,600	124,337,664
Fork Lick	5	2.05	1,312	285,753,600	11,430,144
Glade	5	26.05	16,672	3,631,161,600	145,246,464
Totals		76.25	48,800	10,628,640,000	425,145,600

MINABLE COALS, KANAWHA GROUP OF POTTSVILLE SERIES.

UPPER MERCER COAL.

The Upper Mercer Coal, previously discussed in Chapter VI, page 149, is found in the ridges of the northwestern portion of the county, its horizon passing above the tops of the mountains near the center line of the county as drawn from northeast to southwest. In the region of its occurrence it has been prospected and mined for local domestic fuel at only scattered points, being somewhat lenticular in its occurrence, with a thickness of 2 to 5 feet. As a commercial seam its value is much curtailed both by the slate partings that it nearly always contains and by the patchy nature of its bedding. Its chemical character is exhibited in the Tables of Coal Analyses at the end of this Chapter and its areal extent is shown on Figure 8, which indicates its patchy character, the lack of numerous prospects making it impossible to delineate its minable areas with exactness. Its outcrop is not shown

on Map II but it may be located from its relationship to the Stockton Coal, since it belongs at an interval of only 40 to 50 feet above that bed.



Upper Mercer Coal, Hacker Valley District.

In Hacker Valley District the Upper Mercer is found in the high ridges except in the extreme southeastern corner, next to Randolph County, where its horizon is above the summits. It has been opened principally on the waters of Left Fork of Little Kanawha River, the following exposures having been noted:

The **Lee Casto Prospect (No. 138 on Map II)**, located on the head of Williams Camp Run, 2.1 miles southwest of Cleveland, at an elevation of 1621′ L., had fallen shut and its thickness was not learned.

Alexander Anderson Prospect—No. 139 on Map II.

On the head of Jerry Run of Little Kanawha River, 2.4 miles northeast of Hacker Valley; Upper Mercer Coal; elevation, 2075′ B.

			Ft.	In.
Slate, black			3	0
Coal	1′	5″		
Slate, dark-gray	0	1		
Coal	2	1	3	7
Slate, pavement				

The **Robert McCoy Farm Mine (No. 140 on Map II)**, on Right Fork of Little Kanawha River, 1.5 miles east of Cleveland, was partly filled with water, its apparent thickness being about 3 feet, and its elevation 1700′ B.

The **Cooper Wilson Farm Mine (No. 141 on Map II)**, located on the head of a short branch of Right Fork of Little Kanawha River, 1.8 miles southeast of Cleveland, at an elevation of 1925′ B., had fallen shut and could not be measured. According to the owner the coal was 5 to 6 feet thick, with numerous slate partings.

P. B. Bright Farm Mine—No. 142 on Map II.

On Long Run of Little Kanawha River, 2.7 miles southeast of Cleveland; **Upper Mercer Coal**; elevation, 2025′ B.

			Ft.	In.
Slate, dark				
Coal	1′	10″		
Slate, black	0	2		
Coal	0	7		
Slate, black	0	7		
Coal	1	7	4	9
Slate, pavement				

P. B. Bright Farm Mine—No. 143 on Map II.

On Long Run of Little Kanawha River, 2.6 miles southeast of Cleveland; **Upper Mercer Coal**; elevation, 2025′ B.

			Ft.	In.
Sandstone, massive, **Homewood**, concealed, and black slate			40	0
Coal, soft	1′	0″		
Bone	0	1		
Coal, soft	1	0		
Slate, dark	0	6		
Coal, hard	1	9		
Slate	0	4		
Coal	0	5	5	1
Slate, pavement				

A sample (No. 22) was collected from this opening by D. D. Teets, Jr., presumably from the benches of pure coal, the composition of which is published under **Mine No. 143** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

W. R. Thomas Farm Mine—No. 144 on Map II.

On Right Fork of Little Kanawha River, 2 miles south of Goshen; **Upper Mercer Coal**; elevation, 2420′ B.

			Ft.	In.
Slate, black				
Coal	4′	0″		
Coal, bony	0	4		
Coal	2	6	6	10
Slate, pavement				

On the waters of Left Fork of Holly River, the coal has been opened at several points, the following prospects being noted:

The **Jesse Cowgar Prospect (No. 145 on Map II)**, located on Long Run of Left Fork of Holly, 2.8 miles southward from Poling, had fallen shut and its thickness was not learned, the elevation being 1785′ B.

John Cowger Farm Mine—No. 146 on Map II.

On Long Run of Left Fork of Holly River, 2.9 miles southeast of Poling; Upper Mercer Coal; elevation, 1870′ B.

	Ft.	In.
Shale, dark		
Sandstone, shaly	4	0
Slate, black	0	6
Coal, slaty	2	9
Slate, pavement		

The **Jacob Klee Prospect (No. 147 on Map II)**, located on the head of Birchpen Run of Laurel Fork of Left Fork of Holly, 2.4 miles north of Penbro, at an elevation of 2400′ B., had fallen shut, but the owner reported 3 feet of coal.

The **Frank Widrig Prospect (No. 148 on Map II)**, located on Right Fork of Laurel Fork of Left Fork of Holly, 1.3 miles north of Penbro, at an elevation of 2600′ B., had fallen shut, being reported by the owner as having several streaks of slate, the thickness of the entire seam not being learned.

Upper Mercer Coal, Holly District.

In Holly District the Upper Mercer crops in the ridges of the central and western portion, its horizon being above the mountain tops in the southeastern end, next to the Randolph County Line. It has been prospected at a few points, principally on the waters of Right Fork of Holly River, the following openings having been noted:

James Lough Prospect—No. 149 on Map II.

On Right Fork of Holly River, 0.9 mile southeast of Removal; Upper Mercer Coal; elevation, 1810′ B.

			Ft.	In.
Slate, dark				
Coal	0′	10″		
Slate, dark	0	3		
Coal, soft	1	8	2	9
Slate, pavement				

John T. McGraw Exposure—No. 150 on Map II.

On Amos Fork of Desert Fork of Right Fork of Holly, 5.4 miles northeast of Jumbo; Upper Mercer Coal; elevation, 2645′ B.

			Ft.	In.
Sandstone, massive, Homewood				
Slate, dark			1	0
Coal	1′	3″		
Bone	0	10		
Coal	0	6		
Slate, reported	0	6		
Coal, reported	1	6	4	7
Concealed to massive sandstone			5	0

At the **M. P. Brooks Exposure (No. 151 on Map II)**, located on Right Fork of Holly, opposite the mouth of Laurel Fork and 2.3 miles southeast of Jumbo, at an elevation of 2260′ B., the opening had fallen shut, being reported 1′ 6″ thick by the owner.

On Elk River the coal was once opened at the **W. B. Tracy Prospect (No. 152 on Map II)**, located 1.2 miles southwest of Tracy Switch, at an elevation of 2410′ B., but the place had fallen shut and its thickness was not learned.

Upper Mercer Coal, Fork Lick District.

In Fork Lick District the Upper Mercer crops only in the extreme northwestern edge, next to the Holly District Line, its horizon elsewhere being above the tops of the mountains. The following prospects were noted:

The **P. F. Gregory Prospect (No. 153 on Map II)**, located on Grassy Creek, 0.7 mile southwest of Kovan, at an elevation of 2370′ B., had fallen shut, the coal being reported 3 feet thick.

The **Theodore Gregory Prospect** (No. 153A on Map II), located on Grassy Creek, 0.3 mile southward from Kovan, at an elevation of 2365′ B., had fallen shut, the coal being reported 2′ 0″ thick by the owner.

Upper Mercer Coal, Glade District.

In Glade District the Upper Mercer crops in the hills of the northwestern portion, next to Braxton and eastern Nicholas, but in the central portion and in the southeastern end, next to Pocahontas and Greenbrier Counties, its horizon is above the tops of the mountains. It has been prospected in the district at a few points, the following openings, principally on the waters of Laurel Creek of Elk River, having been noted:

S. H. Kelly Prospect—No. 154 on Map II.

On Laurel Creek, 1.1 miles southeast of Prestonia; **Upper Mercer Coal**; elevation, 1590′ B.

		Ft.	In.
Sandstone, massive, **Homewood**		50	0
Concealed and shale, gray		9	0
Coal	0′ 2″		
Slate, gray	0 4		
Coal	0 10	1	4

The **Walter Boswell Prospect** (No. 155 on Map II), located on Laurel Creek, 1.1 miles south of Defoe, at an elevation of 1815′ B., was visited by Ray V. Hennen, but the opening had fallen shut, its thickness being reported as 1 foot.

Black Betsey Coal Company Prospect, (Abram Cobb Opening)—No. 156 on Map II.

On Laurel Fork of Birch River, 2.1 miles northeast of Boggs; **Upper Mercer Coal**; elevation, 2165′ B.

		Ft.	In.
1. Sandstone, massive, **Homewood**		90	0
2. Slate, dark		2	0
3. **Coal**	0′ 5″		
4. Slate, dark	0 3		
5. **Coal**, slaty	2 5		
6. **Coal**, soft	0 5½		
7. Slate, gray	0 0½		
8. **Coal**, medium-soft	2 5		
9. Slate, dark	0 1		
10. **Coal**, medium-soft	1 10	7	11
11. Slate, pavement			

A sample (No. 191R) was collected from Nos. 6, 8, and 10 of section, the composition of which is published under **Mine No. 156** in the Survey Table of Coal Analyses at the end of this Chapter.

Keystone Lumber and Mining Company Prospect—No. 157 on Map II.

On a branch of Jacks Run of Birch River, 2.8 miles northwest of Cowen; Upper Mercer Coal; elevation, 2325′ B.

			Ft.	In.
Coal blossom				
Slate, black			0	5
Coal	0′	4″		
Shale, gray	0	3		
Coal	0	7		
Slate, gray	0	4		
Coal, splinty	1	5	2	11
Slate, pavement, and concealed to massive sandstone			2	0

Quantity of Upper Mercer Coal Available.

The following table, compiled by Miss Buchanan from a planimetric measurement of the outcrop on Map II, shows the probable amount of Upper Mercer Coal by districts in the county:

Probable Amount of Upper Mercer Coal.

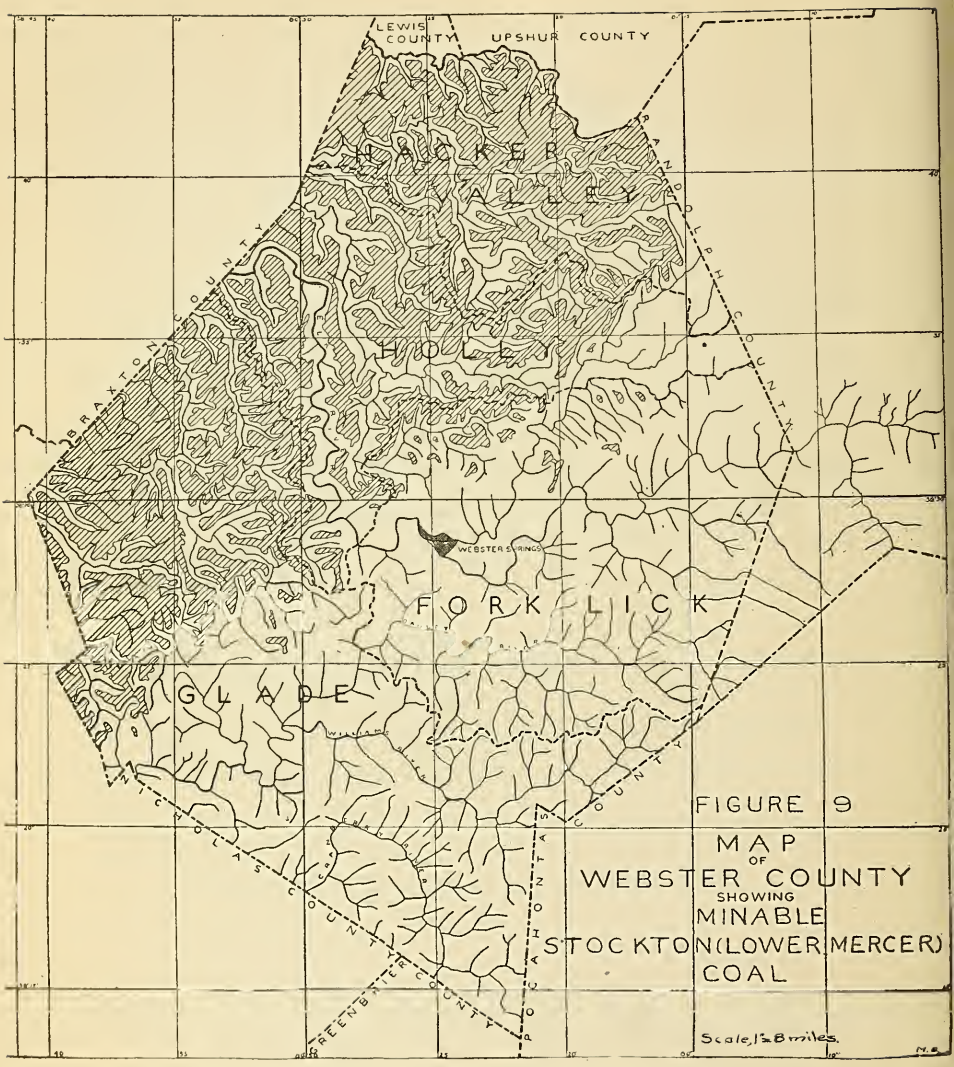
Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	2	38.35	24,544	2,138,273,280	85,530,931
Holly	2	32.10	20,544	1,789,793,280	71,591,731
Fork Lick	2	3.70	2,368	206,300,160	8,252,006
Glade	2	46.25	29,600	2,578,752,000	103,150,080
Totals		120.40	77,056	6,713,118,720	268,524,748

STOCKTON (LOWER MERCER) COAL.

The Stockton Coal (Lower Mercer of Pennsylvania), previously discussed in Chapter VI, pages 151-2, is found in the ridges of the northwestern half of the county, next to Upshur, Lewis, Braxton and Nicholas Counties, its horizon passing above the tops of the mountains along a line slightly northwest of Webster Springs, southeast of which it can be found in only a few isolated tops. In the region of its occurrence it has been prospected and mined for local fuel at numerous points, being fairly regular in its occurrence, with a thickness of 2 to 5 feet, its value as a commercial coal being somewhat impaired by the presence of a slate or bony parting that is usually found not far below the middle of the seam. Its outcrop is shown on Map II and Figure 9 shows its areal extent.

Stockton (Lower Mercer) Coal, Hacker Valley District.

In Hacker Valley District the Stockton is found in the ridges in the central and western portions, its horizon being above the hills only in the extreme southeastern corner, next to the Randolph line. On the waters of Right Fork of Little Kanawha River, the following openings were noted:


LEWIS COUNTY
UPSHUR COUNTY
BRAXTON COUNTY
RANDOLPH COUNTY
HACKER VALLEY
HOLLY
WEBSTER SPRINGS
FORK LICK
GLADE
NICHOLAS COUNTY
GREENBRIER COUNTY
POCAHONTAS COUNTY
FIGURE 9
MAP
OF
WEBSTER COUNTY
SHOWING
MINABLE
STOCKTON (LOWER MERCER)
COAL
Scale, 1 in 8 miles.

The following prospect had fallen shut, its section being reported by a resident:

Robert McCartney Prospect—No. 158 on Map II.

On Threelick Run of Little Kanawha River, 1.5 miles southwest of Bois; Stockton (Lower Mercer) Coal; elevation, 1410′ B.

			Ft.	In.
Sandstone, massive, cliff			20	0
Concealed			10	0
Coal, reported	2′	10″		
Shale, reported	5	0		
Coal, reported	0	8	8	6

The bottom coal was reported to be good shop coal, being evidently low in sulphur.

Lee Casto Farm Mine—No. 159 on Map II.

On the head of Williams Camp Run of Little Kanawha River; Stockton (Lower Mercer) Coal; elevation, 1594′ L.

			Ft.	In.
Slate, dark				
Coal, soft	0′	6″		
Coal, slaty	1	6		
Coal, hard	0	6		
Slate, dark	0	3		
Coal, visible	1	2	3	11
Concealed by mud				

Lewis Anderson Farm Mine—No. 160 on Map II.

On Jerry Run of Little Kanawha River, 1.2 miles southward from Cleveland; Stockton (Lower Mercer) Coal; elevation, 1680′ B.

			Ft.	In.
Sandstone, massive				
Slate, black			2	0
Coal, slaty	1′	0″		
Slate, black, bony	0	7		
Coal, medium-hard	2	11	4	6
Slate, pavement				

The W. S. Anderson Farm Mine (No. 161 on Map II), located on Jerry Run of Little Kanawha River, 2 miles southward from Cleveland, at an elevation of 1750′ B., had fallen shut and could not be measured, the coal being reported 6 feet thick with a parting.

Brooks Powers Farm Mine—No. 162 on Map II.

On a short branch of Right Fork of Little Kanawha River, 0.6 mile south of Cleveland, Stockton (Lower Mercer) Coal; elevation, 1630′ B.

			Ft.	In.
Slate, black				
Coal, medium-hard	1′	0″		
Slate, black	0	5		
Coal, medium-hard	2	5		
Coal, splint	0	6	4	4
Slate, pavement				

At Coal Prospect No. 163 on Map II, located on the same branch of Little Kanawha River, 0.7 mile south of Cleveland, at an elevation of 1640′ B., the opening had fallen shut and its thickness was not learned. At this point the Kanawha Black Flint fossils were noted in the roof shales.

I. J. Hutchinson Farm Mine—No. 164 on Map II.

On Jerry Run of Little Kanawha River, 2.8 miles southeast of Cleveland; Stockton (Lower Mercer) Coal; elevation, 1895′ B.

			Ft.	In.
Shale, dark-gray			5	0
Coal, soft	0′	11″		
Slate, black	0	4		
Coal, soft	2	0	3	3
Slate, pavement				

Wesley Lewis Farm Mine—No. 165 on Map II.

On Jerry Run of Little Kanawha River, 3.4 miles southeast of Cleveland; Stockton (Lower Mercer) Coal; elevation, 1945′ B.

			Ft.	In.
Sandstone, massive				
Coal, medium-hard	0′	11″		
Slate, black	0	7		
Coal, medium-hard	2	5	3	11
Slate, pavement				

Phoebe J. Cutlip Farm Mine—No. 166 on Map II.

On Jerry Run of Little Kanawha River, 3.8 miles southeast of Cleveland; **Stockton (Lower Mercer) Coal**; elevation, 1985′ B.

			Ft.	In.
Sandstone, massive			10	0
Coal, medium-hard	1′	0″		
Slate, black, soft	0	5		
Coal, soft	1	2		
Coal, hard, splinty	0	6	3	1
Slate, pavement				

At the following opening the mine had fallen shut, the section being reported by Cooper Wilson, a near-by resident:

Ferrell Brothers Farm Mine—No. 167 on Map II.

On Buffalo Run of Little Kanawha River, 1.8 miles southeast of Cleveland; **Stockton (Lower Mercer) Coal**; elevation, 1780′ B.

			Ft.	In.
Coal, reported	3′	6″		
Slate, 1½″ to	0	4		
Coal, reported	1	8	5	6

On the waters of Left Fork of Holly River several openings have been made, the following having been noted:

A. Shreve Farm Mine—No. 168 on Map II.

On a short branch of Left Fork of Holly River, 0.7 mile southwest of Replete; **Stockton (Lower Mercer) Coal**; elevation, 1510′ B.

			Ft.	In.
Sandstone, massive, and sandy shale				
Slate, black, Kanawha Black Flint			1	6
Coal, splinty	1′	1″		
Slate, bony	0	4		
Coal, semi-splint	1	7	3	0
Slate, pavement				

Samuel Fisher Farm Mine—No. 169 on Map II.

On Long Run of Left Fork of Holly River, 2.1 miles south of Poling; **Stockton (Lower Mercer) Coal**; elevation, 1660′ B.

			Ft.	In.
Slate, dark				
Coal	0′	3″		
Shale, dark	0	10		
Coal, soft	1	8		
Coal, hard, bony	0	7		
Coal, splinty	1	5	4	9
Slate, pavement				

Noah Harper Farm Mine—No. 170 on Map II.

On Long Run of Left Fork of Holly River, 2.4 miles southward from Poling; Stockton (Lower Mercer) Coal; elevation, 1735′ B.

			Ft.	In.
Shale, sandy				
Coal	0′	3″		
Slate, dark	0	11		
Coal, soft	2	0		
Coal, hard	0	7		
Slate, gray	0	4		
Coal, hard	0	10	4	11
Slate, pavement				

Jesse Cowger Farm Mine—No. 171 on Map II.

On Long Run of Left Fork of Holly River, 2.9 miles southward from Poling; Stockton (Lower Mercer) Coal; elevation, 1760′ B.

			Ft.	In.
Shale, sandy			5	0
Coal	1′	4″		
Shale, sandy	5	0		
Coal	1	10	8	2
Slate, pavement				

Coal Opening No. 172 on Map II, located on Long Run, a short distance farther east than the above mine, and 2.9 miles southward from Poling, had fallen shut and could not be measured, its elevation being 1810′ B.

John Cowger Farm Mine—No. 173 on Map II.

On Long Run of Left Fork of Holly River, 2.9 miles southward from Poling; Stockton (Lower Mercer) Coal; elevation, 1835′ B.

			Ft.	In.
Shale, sandy			15	0
Slate, black			2	0
Coal, medium-hard	2′	8″		
Shale, black, bony	0	7		
Coal, hard	1	8	4	11
Slate, pavement				

Coal Prospect—No. 174 on Map II.

On a short branch of Left Fork of Holly River, 0.6 mile north of Poling; Stockton (Lower Mercer) Coal; elevation, 1530′ B.

	Ft.	In.
Slate, black, with Naiadites, Kanawha Black Flint	1	0
Coal, visible	1	0
Concealed by mud		

W. Howard Anderson Farm Mine—No. 175 on Map II.

On Left Fork of Holly River, 0.3 mile northeast of Poling; **Stockton (Lower Mercer) Coal**; elevation, 1610′ B.

			Ft.	In.
Sandstone, shaly				
Slate, black, fossiliferous (Naiadites, etc.) Kanawha Black Flint			1	0
Coal			1	1
Shale, gray, sandy			5	0
Coal, soft	0′	8″		
Slate, black	0	4		
Coal, medium-hard	1	4		
Slate, black, bony	0	3		
Coal, splinty	2	3	4	10
Slate, pavement				

Charles Marple Farm Mine—No. 176 on Map II.

On Radabaugh Run of Left Fork of Holly River, 1.5 miles northeast of Poling; **Stockton (Lower Mercer) Coal**; elevation, 1685′ B.

			Ft.	In.
Slate, black				
Coal	0′	10″		
Slate, dark	0	3		
Coal	1	10		
Slate, reported	0	8		
Coal, reported	1	6	5	1

The H. F. Anderson Farm Mine (No. 177 on Map II), located on Left Fork of Holly, 1.4 miles northeast of Poling, was partly full of water, about 3 feet of coal being visible, at an elevation of 1705′ B.

Levi S. Shinn Heirs Prospect—No. 178 on Map II.

On Laurel Fork of Left Fork of Holly River, 1 mile northeast of Hacker Valley; **Stockton (Lower Mercer) Coal**; elevation, 2015′ B.

			Ft.	In.
Sandstone, massive				
Coal, medium-soft	0′	9″		
Coal, hard, splinty	0	6		
Slate, black	0	9		
Coal, medium-hard	0	10	2	10
Slate, pavement, and concealed			5	0
Sandstone, massive			20	0

Newton Barbe Farm Mine—No. 179 on Map II.

On Left Fork of Holly River, 2 miles southeast of Hacker Valley; **Stockton (Lower Mercer) Coal**; elevation, 2225′ B.

	Ft.	In.
Sandstone, massive		
Slate, black	1	0
Sandstone, massive	2	0
Coal, medium-hard, splinty	2	8
Slate, pavement		

Stockton (Lower Mercer) Coal, Holly District.

In Holly District the Stockton Coal crops in the ridges of the central and western portions, but in the eastern end, next to the Randolph County Line, its horizon is above the tops of the hills. Several openings have been made along the waters of Right Fork of Holly River, the following having been noted:

Wesley Cowger Farm Mine—No. 180 on Map II.

On Blaze Fork of Oldlick Creek, 2.1 miles southwest of Poling; **Stockton (Lower Mercer) Coal**; elevation, 1590′ B.

		Ft.	In.
Shale, sandy			
Slate, black, **Kanawha Black Flint**		2	0
Coal, medium-soft	1′ 6″		
Slate, black, bony	0 4		
Coal, hard, splinty	2 0	3	10
Slate, pavement			

The **Oldlick Run Coal and Coke Company Prospect (No. 181 on Map II)**, located on Oldlick Creek, 1.1 miles eastward from Fishers Crossing, at an elevation of 1690′ B., had fallen shut, its thickness not being learned.

A. J. Salisbury Prospect—No. 182 on Map II.

On Right Fork of Holly River, 0.4 mile northward from Salisbury Station; **Stockton (Lower Mercer) Coal**; elevation, 1715′ B.

	Ft.	In.
Sandstone, massive cliff, **Homewood**, etc.	100	0
Concealed	3	0
Slate, dark, with shells, **Kanawha Black Flint**	1	0

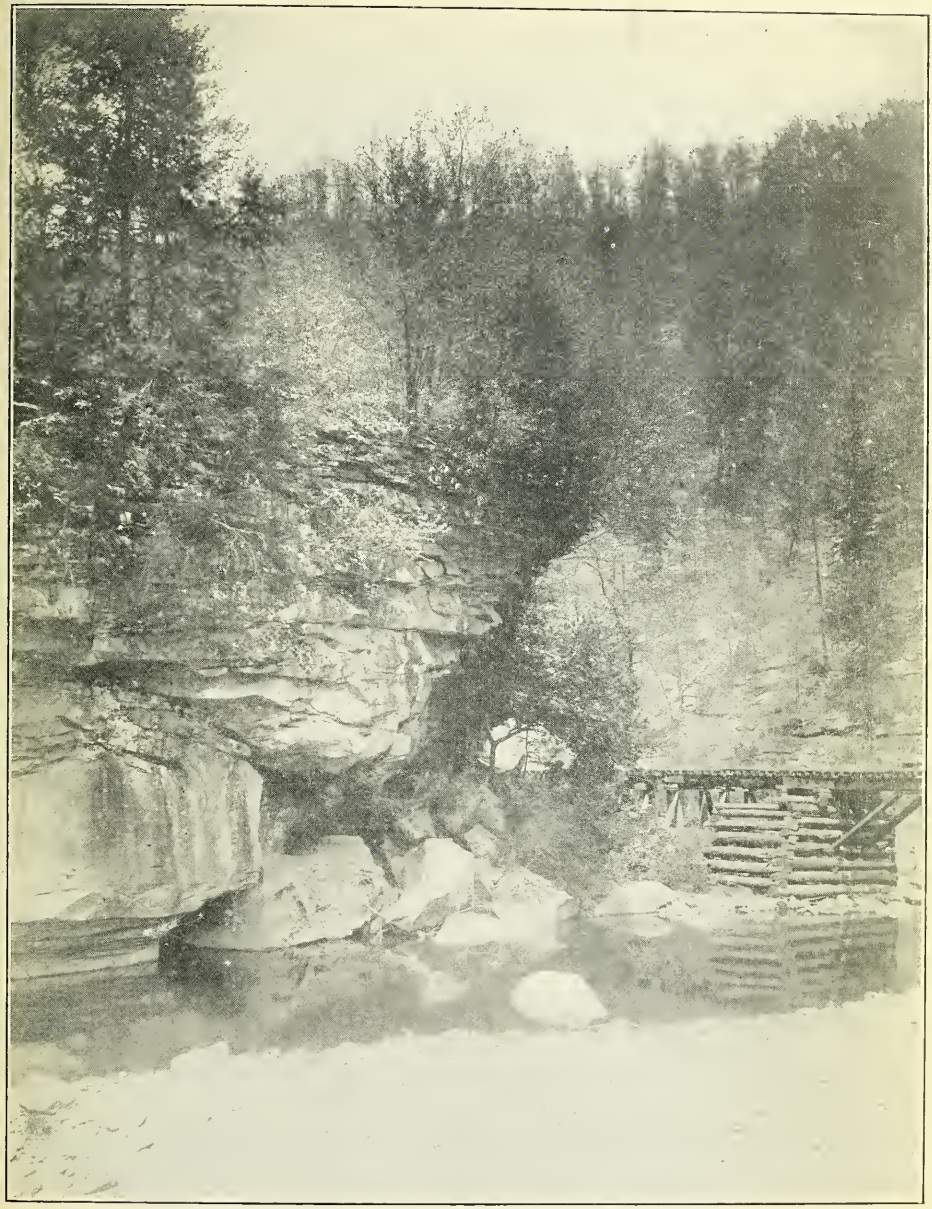


PLATE XXII.—View of Lower Gilbert Sandstone at Diana; Topography of Pottsville Series.

			Ft.	In.
Coal, soft	2′	0″		
Slate	0	5		
Coal	1	6		
Slate, dark	0	2		
Coal	0	9	4	10
Slate, pavement				

James Lough Prospect—No. 183 on Map II.

On Right Fork of Holly River, 0.9 mile southeast of Salisbury Station; **Stockton (Lower Mercer) Coal**; elevation, 1765′ B.

			Ft.	In.
Slate, dark, broken				
Coal, broken, about	1′	6″		
Slate, gray	1	0		
Coal	1	0	3	6
Slate, pavement				

The above prospect had not been driven into the hill far enough to find the solid roof of the coal, and the upper bench as recorded may not represent its full thickness.

Tanner & Cutlip Farm Mine—No. 184 on Map II.

On Right Fork of Holly River, 0.5 mile southeast of Diana; **Stockton (Lower Mercer) Coal**; elevation, 1930′ B.

			Ft.	In.
Slate, dark				
Coal, soft	2′	5″		
Coal, hard, splinty	0	5		
Coal, soft	1	6	4	4
Slate, pavement				

A sample (No. 235R) was collected from Nos. 2, 3, and 4 of section, the composition of which is published under **Mine No. 184** in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 26) was collected by D. D. Teets, Jr., its analysis being published in the Bethlehem Steel Company Table on a following page. At this opening the usually bony parting has entirely disappeared, this member being represented by splinty coal.

Pardee & Curtin Lumber Company Prospect—No. 185 on Map II.

On Grassy Creek, 0.8 mile northward from Summit Station; **Stockton (Lower Mercer) Coal**; elevation, 2010′ B.

			Ft.	In.
Shale, sandy, dark, with marine fossils, Kanawha Black Flint				
Coal, soft	1′	1″		
Slate, black	0	6		
Coal	1	0		
Slate, dark	0	4		
Coal	1	8	4	7
Slate, pavement				

At the **L. A. Brooks Prospect (No. 186 on Map II)**, located on Grassy Creek, 0.2 mile northeast of Summit Station, at an elevation of 2105′ B., the coal measured 4′ 6″, with partings, as detailed in the section for Summit, page 87.

The **Strange Riffle Prospect (No. 187 on Map II)**, located on Right Fork of Holly River, 1.2 miles southeast of Jumbo, at an elevation of 2125′ B., measured 3′ 3″ of clean, medium-soft coal.

The **G. W. Curtin Heirs Prospects Nos. 188**, with an elevation of 2200′ B., and **189**, with an elevation of 2175′ B., located on Right Fork of Holly River, 1.9 miles southeast of Jumbo, had fallen shut and their thicknesses were not learned.

The **M. P. Brooks Prospect (No. 190 on Map II)**, located on Right Fork of Holly River, opposite the mouth of Laurel Fork and 2.2 miles southeast of Jumbo, at an elevation of 2240′ B., measured 3′ 3″, as detailed in the section for Laurel Fork of Holly, page 85.

Harmon Bell Farm Mine—No. 191 on Map II.

On Right Fork of Holly River, 2.7 miles southeast of Jumbo; **Stockton (Lower Mercer) Coal**; elevation, 2285′ B.

			Ft.	In.
Coal, visible	0′	6″		
Coal, bony	0	10		
Coal, soft	2	4		
Coal, bony	0	2		
Coal, soft	0	8	4	6
Slate, pavement				

W. B. Tracy Prospect—No. 192 on Map II.

On the south side of Elk River, 1.1 miles southwest of Tracy Switch; **Stockton (Lower Mercer) Coal**; elevation, 2340′ B.

			Ft.	In.
Sandstone, massive				
Slate, black, cannelly, with marine fossils, Kanawha Black Flint			5	0
Coal, hard	1′	9″		
Slate, black, soft	0	2		
Coal, soft	1	0		
Coal, hard, splinty	1	10	4	9
Slate, pavement				

Stockton (Lower Mercer) Coal, Fork Lick District.

In Fork Lick District the Stockton crops only in the ridges of a narrow strip in the northwestern corner, next to the Holly District Line, its horizon elsewhere being above the tops of the mountains except in a very few isolated summits. Some openings have been made along the waters of Grassy Creek, the following having been noted:

Harrison Cochran Prospect—No. 193 on Map II.

On Grassy Creek, 1.1 miles southeast of Summit Station; **Stockton (Lower Mercer) Coal**; elevation, 2255′ B.

			Ft.	In.
Slate, dark				
Coal, hard, splinty	1′	3″		
Coal, bony splint	1	0		
Coal, splinty	1	4	3	7
Slate, pavement, and concealed			5	0
Sandstone, massive				

The **P. F. Gregory Farm Mine** (No. 194 on Map II), located on a short branch of Grassy Creek, 0.6 mile southwest of Kovan, at an elevation of 2325′ B., had fallen shut, the thickness of the coal being reported as 4 feet, with a parting.

The **French Miller Farm Mine** (No. 195 on Map II), located on Grassy Creek, 0.4 mile southwest of Kovan, at an elevation of 2320′ B., had fallen shut, its thickness being reported 2′ 6″, clean coal.

The following opening had fallen shut, its section being reported as follows by the owner:

Theodore Gregory Prospect—No. 196 on Map II.

On Grassy Creek, 0.2 mile southwest of Kovan; **Stockton (Lower Mercer) Coal**; elevation, 2325′ B.

		Ft.	In.
Coal, reported	1′ 0″		
Slate, 4″ to	0 10		
Coal, reported	0 11	2	9

Farm Mine No. 197 on Map II, located on Grassy Creek, 0.5 mile north of Kovan, at an elevation of 2280′ B., had fallen shut, its thickness not being learned.

G. W. Curtin Heirs Farm Mine—No. 198 on Map II.

On Grassy Creek, 0.6 mile northward from Kovan; **Stockton (Lower Mercer) Coal**; elevation, 2270′ B.

	Ft.	In.
Slate, dark, fossiliferous? **Kanawha Black Flint**		
Coal, medium-soft, columnar	3	3
Slate, pavement		

Lock Gregory Farm Mine—No. 199 on Map II.

On Grassy Creek, 0.4 mile northeast of Kovan; **Stockton (Lower Mercer) Coal**; elevation, 2305′ B.

	Ft.	In.
Slate, dark		
Coal, medium-soft, columnar	3	7
Slate, pavement		

A sample (No. 8) was collected from this opening by D. D. Teets., Jr., the composition of which is published under **Mine No. 199** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Isaac Gregory Farm Mine—No. 200 on Map II.

On a branch of Grassy Creek, 0.8 mile southeast of Kovan; **Stockton (Lower Mercer) Coal**; elevation, 2570′ B.

			Ft.	In.
Slate, black				
Coal, medium-soft	2′	1″		
Coal, bony	0	4	2	5
Slate, pavement				

Stockton (Lower Mercer) Coal, Glade District.

In Glade District the Stockton crops in the ridges of the western third, next to Braxton and Nicholas Counties, but in the central and southeastern portions its horizon is above the tops of the mountains. Several openings have been made on the waters of Laurel Creek of Elk River, the following having been noted:

Stalnaker and Hines Prospect—No. 201 on Map II.

On Upper Laurel Fork of Camp Creek, 2.4 miles southeast of Defoe; **Stockton (Lower Mercer) Coal**; elevation, 1980′ B.

			Ft.	In.
Sandstone, massive				
Coal, medium-soft	1′	5″		
Shale, gray	0	2		
Coal, hard	1	0	2	7
Shale, gray, pavement				

The **Richard Cogar Prospect** (No. 202 on Map II), located on a branch of Camp Creek, 1.1 miles eastward from Prestonia, had fallen shut and could not be measured, its thickness being reported as 8 feet by residents, its elevation being 1600′ B. It seems probable that the thickness named is excessive.

S. H. Kelly Prospect—No. 203 on Map II.

On Laurel Creek, 1.1 miles southeast of Prestonia; **Stockton (Lower Mercer) Coal**; elevation, 1545′ B.

			Ft.	In.
Shale, dark, with marine fossils, Kanawha Black Flint			5	0
Coal	1′	2″		
Slate, bony	0	2		
Coal	0	4	1	8
Shale, gray, pavement				

The following opening is reported by Ray V. Hennen:

Walter Boswell Prospect—No. 204 on Map II.

On Laurel Creek, 1.1 miles south of Defoe; **Stockton (Lower Mercer) Coal**; elevation, 1815′ B.

			Ft.	In.
Shale, buff, sandy			3	0
Sandstone			3	0
Shale, dark, coal streaks near top			0	8
Coal, semi-splint	0′	3″		
Fire clay shale, soft	10″ to 1	0		
Coal, semi-splint	1	6	2	9
Slate				

Stalnaker and Hines Prospect—No. 205 on Map II.

On Amos Run of Laurel Creek, 3.2 miles northeast of Wainville; **Stockton (Lower Mercer) Coal**; elevation, 2130′ B.

			Ft.	In.
Coal blossom	0′	6″		
Slate, gray	1	0		
Coal	0	2		
Slate, gray	3	0		
Coal	2	0	6	8
Slate, pavement				

The above prospect had fallen shut, the section being measured at the outcrop where the upper portion of the bed was obscured.

Stalnaker and Hines Prospect—No. 206 on Map II.

On Amos Run of Laurel Creek, 3.9 miles northeast of Wainville; **Stockton (Lower Mercer) Coal**; elevation, 2180′ B.

			Ft.	In.
Sandstone, massive, cliff, **Homewood**			50	0
Concealed			30	0
Coal blossom			0	8
Shale, gray			3	0
Slate, black, **Kanawha Black Flint**			0	8
Coal	1′	6″		
Slate, black	0	8		
Coal	1	5	3	7
Slate, pavement				

The two prospects noted above, as well as several others previously noted under the description of the Lower Kittan-

ning (No. 5 Block) and other higher coals, are located on a boundary of several thousand acres on which a private report has been made by Clark & Krebs, Civil and Mining Engineers, of Charleston, W. Va., from which the Survey is permitted to quote the following table of analyses through the courtesy of Mr. Krebs:

"Samples taken from a number of openings on the Cary C. Hines property of the Stockton-Lewiston seam, give the following results:

Sample Number	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulphur	B. T. U.
255	0.63	29.18	61.81	8.41	0.77	13,882
256	3.04	25.96	59.70	11.30	0.73	13,395
257	1.67	32.43	62.20	3.70	0.63	14,940
258	1.48	29.87	54.25	14.40	0.60	12,959
259	2.06	30.59	28.54	8.81	0.67	13,855

"Nos. 256 and 258 were taken from the upper benches of this seam, which seems to show that the lower bench is the cleaner one and the most valuable one, as far as purity goes."

A few prospects in the Stockton have been made on the waters of Birch River, the following having been noted:

Davis-Eakin Lumber Company Exposure—No. 207 on Map II.

On Road Fork of Skyles Creek, 1.2 miles southeast of Waggy; Stockton (Lower Mercer) Coal; elevation, 1785′ B.

			Ft.	In.
Sandstone				
Shale, sandy			3	0
Coal	1′	3″		
Bone	0	4		
Coal	0	7	2	2
Shale, gray				

On Jacks Run of Birch River the coal was once opened at the **Keystone Lumber and Mining Company Prospect (No. 208 on Map II)**, located 2.9 miles northwest of Cowen, at an elevation of 2285′ B., having proved to be slaty and impure.

Quantity of Stockton Coal Available.

The following table, compiled by Miss Buchanan from a planimetric measurement of the coal outcrop on Map II,

shows the probable amount of Stockton (Lower Mercer) Coal in the county by districts:

Probable Amount of Stockton (Lower Mercer) Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	3	45.40	29,056	3,797,038,080	151,881,523
Holly	3	37.75	24,160	3,157,228,800	126,289,152
Fork Lick	3	4.60	2,944	384,721,920	15,388,877
Glade	3	57.60	36,864	4,817,387,520	192,695,501
Totals		145.35	93,024	12,156,376,320	486,255,053

COALBURG COAL.

The Coalburg Coal, previously described in Chapter VI, pages 153-4, occurs in minable quantity mainly in western Holly and northwestern Glade Districts. In Hacker Valley District its horizon crops in the hills but the coal seems too thin at most points to be of commercial value. In the region indicated for its areal occurrence in commercial quantity on Figure 10, it varies greatly in thickness and section, being sometimes too thin for mining and thickening elsewhere to a maximum of 10 feet, its character being indicated as "patchy" by an appropriate line shading on the figure. Its outcrop is not shown on Map II, but its position may be readily determined in each locality by reference to the Table of Intervals, pages 55 and 57, showing its relationship to the Stockton Coal.

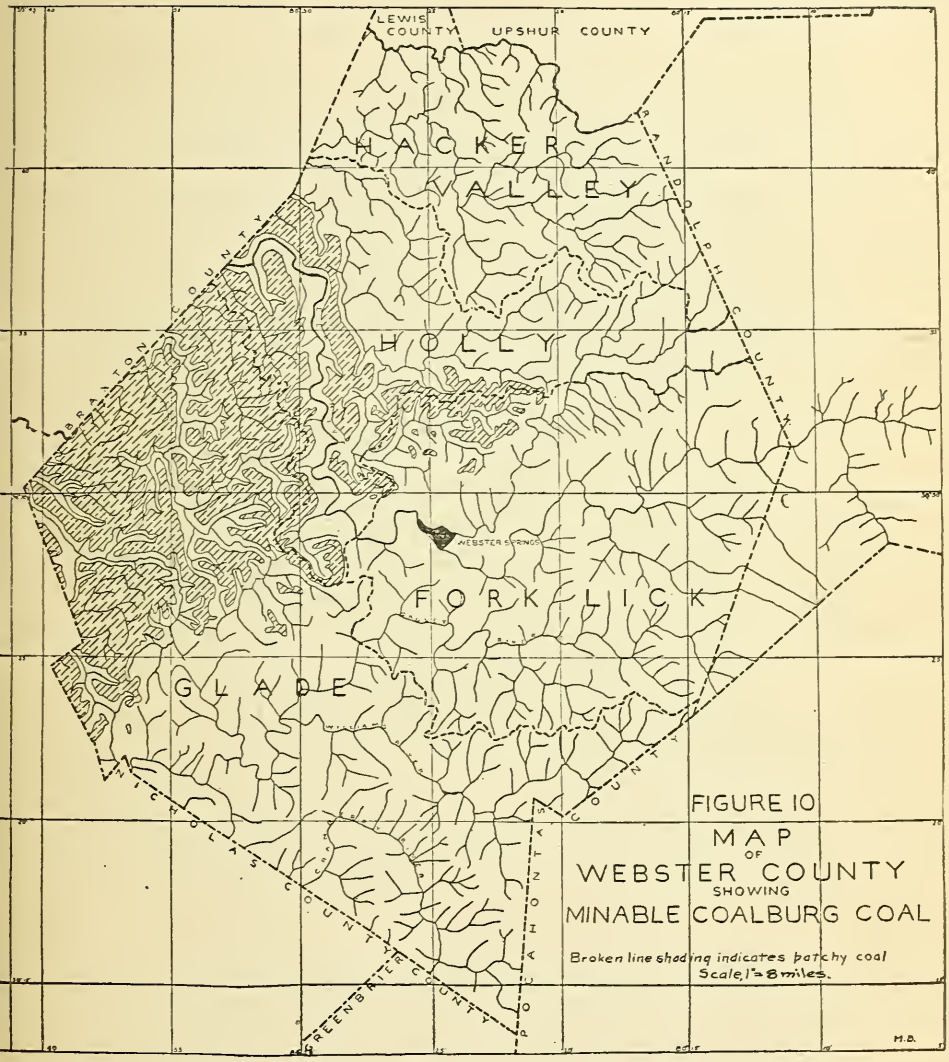


FIGURE 10

MAP OF WEBSTER COUNTY SHOWING MINABLE COALBURG COAL

Broken line shading indicates patchy coal

Scale, 1" = 8 miles.

Coalburg Coal, Hacker Valley District.

In Hacker Valley District coal was noted at the Coalburg horizon at only a few points, although its horizon belongs in the ridges of the major part of the region. The **John Cowger Prospect (No. 209 on Map II)**, located on Long Run of Left Fork of Holly River, 2.8 miles southeast of Poling, at an elevation of 1800′ B., measured 1′ 9″ of clean, hard coal, being 35 feet beneath the Stockton.

The coal was once opened at the **Charles Marple Prospect (No. 210 on Map II)**, located on Radabaugh Run of Left Fork of Holly River, 1.4 miles northeast of Poling, but the place had fallen shut and its thickness was not learned, the elevation being 1595′ B.

Coalburg Coal, Holly District.

In Holly District the Coalburg Coal seems to be of value mainly in the region west of the line formed by Right Fork of Holly River and its tributary stream, Grassy Creek, as shown by Figure 10, the following openings having been noted:

G. W. Curtin Heirs Mine—211 on Map II.

On Grassy Creek, 0.8 mile northeast of Summit Station; **Coalburg Coal**; elevation, 1960′ B.

			Ft.	In.
Shale, sandy, dark			5	0
Coal, cannel	0′	4″		
Coal, medium-hard	2	8	3	0
Slate, pavement				

The **M. P. Brooks Prospect (No. 212 on Map II)**, located on Right Fork of Holly River, opposite the mouth of Laurel Fork and 2.2 miles southeast of Jumbo, at an elevation of 2210′ B., had fallen shut, but the coal was reported 1′ 0″ thick by the owner.

What appears to be the Coalburg Coal was once opened at the **R. F. Tanner Prospect (No. 212A on Map II)**, on Right Fork of Holly, 0.7 mile northeast of Big Run Station, measur-

ing 6′ 4″, with a parting, as exhibited in the section for Big Run, page 80, its elevation being 1770′ B.

The **Andrew McCourt Heirs Prospect (No. 213 on Map II),** located on the south side of Elk River, 1.4 miles southwest of Summit Station, at an elevation of 2045′ B., measured 9′ 7″, with partings, as detailed in the section for McCourt Ford, page 89, being the best exposure of this seam found in the county.

Coalburg Coal, Fork Lick District.

In Fork Lick District, the Coalburg crops mainly in the extreme western portion, the following openings being noted:

Harrison Cochran Prospect—No. 214 on Map II.

On Grassy Creek, 1.1 miles southeast of Summit Station; Coalburg Coal; elevation, 2140′ B.

	Ft.	In
Cannel slate	0	8
Coal, reported	4	0
Slate, pavement		

The above prospect had fallen shut, its section being reported by the owner.

J. G. Ware Prospect—No. 215 on Map II.

On Warner Run of Grassy Creek, 0.5 mile north of Orndoff; Coalburg Coal; elevation, 2305′ B.

			Ft.	In.
Shale, sandy				
Coal, cannel	0′ 2″			
Coal, medium-soft	1 10		2	0
Slate, pavement				

Coalburg Coal, Glade District.

In Glade District, the Coalburg Coal crops in the western end, next to Braxton and Nicholas Counties, but in the central and southeastern portions its horizon is above the tops of the mountains. In the region where it occurs it has been prospected only at infrequent points but the fact that this portion of the county borders on northern Nicholas where the character of the Coalburg is similar to that of its type locality

would indicate that further prospecting could be done with profit. The following openings were noted:

The **B. W. Clifton Farm Mine (No. 216 on Map II)**, located on Whiteoak Run of Laurel Creek, 1 mile southeast of Defoe, at an elevation of 1785′ B., measured 1′ 8″ of clean coal.

Keystone Lumber and Mining Company Prospect—No. 217 on Map II.

On Jacks Run of Birch River, 2.9 miles northwest of Cowen; **Coalburg Coal**; elevation, 2200′ B.

			Ft.	In.
1. Sandstone, massive				
2. **Coal**	2′	1½″		
3. Slate, gray	0	4½		
4. **Coal**	2	3	4	9
5. Slate, pavement				

A sample (No. 186R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 217** in the Survey Table of Coal Analyses at the end of this Chapter.

Farley Crites Farm Mine—No. 218 on Map II.

On Strouds Creek, 0.9 mile southeast of Tioga; **Coalburg Coal**; elevation, 2225′ B.

			Ft.	In.
Sandstone, shaly			10	0
Coal, bony	0′	5″		
Coal, soft	0	11		
Bone	0	2		
Coal, soft	0	6		
Coal, bony	0	4		
Coal, medium-hard	0	11	3	3
Slate, pavement				

Edwin Jones Farm Mine—No. 219 on Map II.

On Strouds Creek, 1 mile southeast of Tioga; **Coalburg Coal**; elevation, 2225′ B.

			Ft.	In.
Sandstone, shaly				
Coal	0′	3″		
Slate, gray	0	1		
Coal, soft	0	10		
Bone	0	2		
Coal, soft	0	7		
Coal, bony	0	3		
Coal, medium-hard	0	10	3	0
Slate, pavement				

Cytha Roberts Farm Mine—No. 220 on Map II.

On Board Fork of Beaver Creek, 2.1 miles southeast of Tioga; **Coalburg Coal**; elevation, 2340′ B.

			Ft.	In.
Slate, dark			4	0
Coal	0′	10″		
Slate, dark	1	0		
Coal, slaty	0	10		
Coal, good	0	4		
Slate, gray	0	1		
Coal, hard	1	5	4	6
Slate, pavement				

Quantity of Coalburg Coal Available.

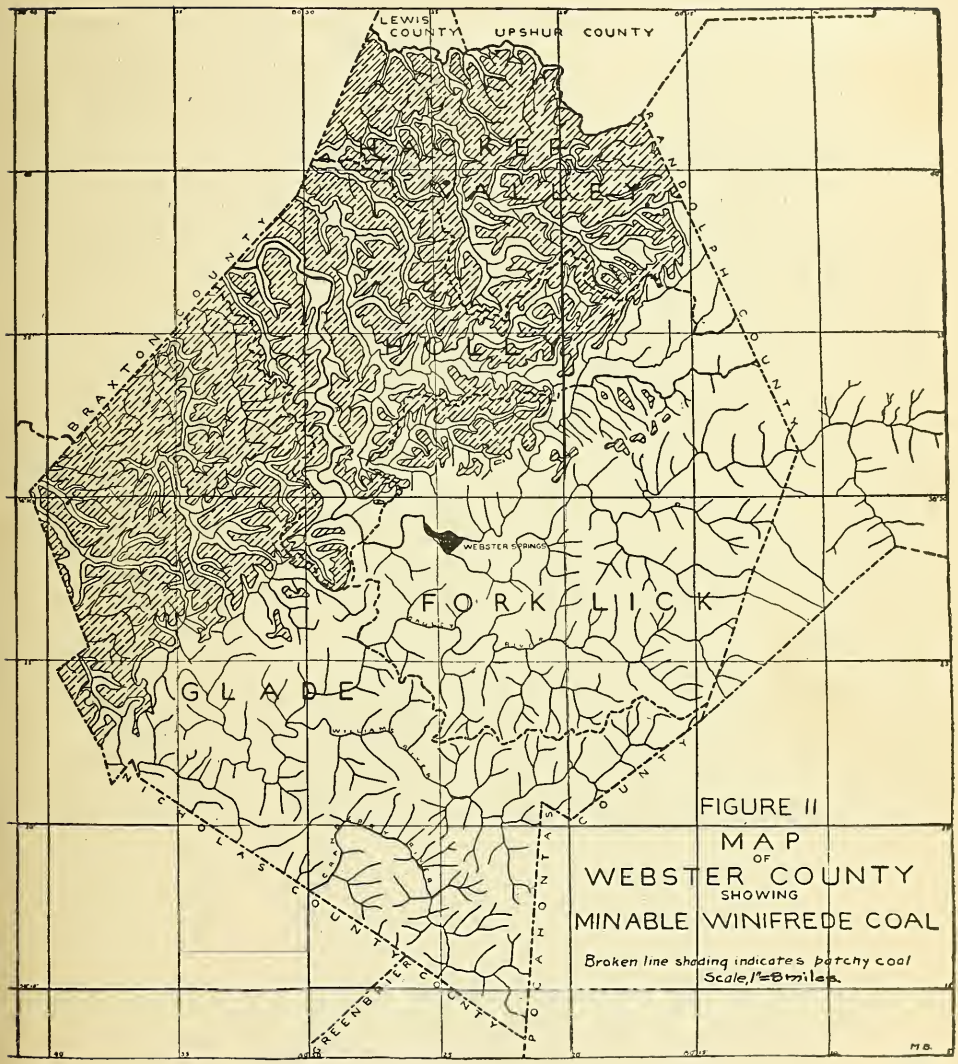
The following table, compiled by Miss Buchanan, gives a close estimate of the acreage and tonnage, based on the intervals of the Coalburg below the Stockton and above the Cedar Grove Coals. The assumed thickness of the coal is purposely made low because of the barren areas known to exist in the region included in the estimate, causing the average thickness to be much less than the average that might be obtained from the prospects, as recorded on previous pages:

Probable Amount of Coalburg Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Holly	2	20.00	12,800	1,115,136,000	44,605,440
Fork Lick	2	4.70	3,008	262,056,960	10,482,278
Glade	2	61.80	39,552	3,445,770,240	137,830,810
Totals		86.50	55,360	4,822,963,200	192,918,528

WINIFREDE COAL.

The Winifrede Coal, previously discussed in Chapter VI, pages 155-7, is found in the ridges of the northwestern half of the county, next to Upshur, Lewis, Braxton, and Nicholas Counties, its horizon passing above the tops of the mountains in the southeastern half. In the region of its occurrence it has been prospected and mined for local domestic fuel at infrequent points, sometimes showing a thickness of 3 to 4 feet, and at other points being only poorly represented. Figure 11 shows its areal extent, the broken line shading indicating the patchy nature of its occurrence. Its outcrop is not shown on Map II but its position at any point may be determined with fair accuracy from its relationship to the Stockton Coal as exhibited in the Table of Intervals, pages 55 and 57.


LEWIS COUNTY
UPSHUR COUNTY
RANDOLPH COUNTY
BRAXTON COUNTY
NICHOLAS COUNTY
GREENBRIER COUNTY
WEBSTER SPRINGS
HACKER VALLEY
FORK LICK
GLADE
FIGURE 11
MAP
OF
WEBSTER COUNTY
SHOWING
MINABLE WINIFREDE COAL
Broken line shading indicates patchy coal
Scale, 1"=8 miles.
M.B.

Winifrede Coal, Hacker Valley District.

In Hacker Valley District the Winifrede crops in the ridges of almost the entire region, as its horizon is above the hilltops only in the southeastern corner, next to Randolph County. It has been prospected only at infrequent points, the following openings having been noted:

The **Robert Berry Prospect (No. 221 on Map II)**, located on Left Fork of Holly River, 0.9 mile eastward from Poling, had fallen shut, its thickness being reported 3′ 0″, and its elevation being 1550′ B.

Webster Cowger Farm Mine—No. 222 on Map II.

On Long Run of Left Fork of Holly River, 2.8 miles southeast of Poling; Winifrede Coal; elevation, 1750′ B.

		Ft.	In.
Sandstone, massive			
Coal, medium-hard	1′ 3″		
Slate, black, bony	0 4		
Coal, splinty	0 10	2	5
Slate, pavement			

The **Mayton Lumber Company Prospect (No. 223 on Map II)**, located on a branch of Hodam Creek, 0.8 mile west of Hodam village, at an elevation of 2075′ B., had partly fallen shut, only about 1 foot of coal being visible, the entire thickness of the seam being reported as 4 to 5 feet.

Winifrede Coal, Holly District.

In Holly District the Winifrede belongs in the ridges of all except the eastern end, next to Randolph, where its horizon rises above the tops of the mountains. It has been prospected at only a few points, the following openings having been noted:

PLATE XXIII.—View along Right Fork of Holly River west of Diana, showing U-shaped valley; Topography of Allegheny and Pottsville Series.

Pardee & Curtin Lumber Company Prospect—No. 224 on Map II.

On Grassy Creek, 0.9 mile northeast of Summit Station; **Winifrede Coal**; elevation, 1920′ B.

			Ft.	In.
Shale, sandy				
Coal	0′	5″		
Slate, gray	0	4		
Coal	1	10	2	7
Slate, pavement				

J. W. Brooks Prospect—No. 225 on Map II.

On Grassy Creek, 0.2 mile northeast of Summit Station; **Winifrede Coal**; elevation, 1980′ B.

			Ft.	In.
Shale, sandy				
Coal, soft	1′	6″		
Slate, sandy	0	2		
Coal, soft	0	8		
Coal, cannel	0	7		
Slate, gray	1	0		
Coal, hard, bony	0	11	4	10
Slate, pavement				

What seems to be the same coal, although having a somewhat different section appears at the **West Virginia Midland Railroad Exposure (No. 226 on Map II)**, in the Grassy Creek-Elk River summit, just southwest of Summit Station, having a basal elevation of 1959′ B., and being composed of two benches of coal as detailed in the section for Summit, page 87.

The **John T. McGraw Prospect (No. 227 on Map II)**, located on Desert Fork of Right Fork of Holly River, near the mouth of Carlo Run and 3.1 miles northeast of Jumbo, measured 1′ 11″ of clean, medium-hard coal, at an elevation of 2245′ B.

The **M. P. Brooks Prospect (No. 228 on Map II)**, located on Right Fork of Holly River, opposite the mouth of Laurel Fork and 2.2 miles southeast of Jumbo, at an elevation of 2160′ B., had fallen shut, but the coal was reported by the owner as being 1′ 2″ thick.

James Cogar Farm Mine—No. 229 on Map II.

On Laurel Fork of Right Fork of Holly River, 0.7 mile northwest of Skelt; **Winifrede Coal**; elevation, 2420′ B.

			Ft.	In.
Coal	1′	0″		
Shale, sandy	6	0		
Coal	2	6	9	6
Slate, pavement				

What appears to represent the Winifrede Coal was once opened at the **Jonathan Bennett Prospect (No. 230 on Map II)**, on a short branch of Elk River, 0.7 mile northeast of Tracy Switch, at an elevation of 2210′ B., its thickness not being learned.

Winifrede Coal, Fork Lick District.

In Fork Lick District the Winifrede crops over a few square miles of ground along the northwestern edge, its horizon elsewhere being above the mountains except at a few high tops. The following openings were noted along the waters of Grassy Creek:

G. W. Curtin Heirs Prospect (Ezra Fisher Opening)—No. 231 on Map II.

On Grassy Creek, 1.7 miles southwest of Orndoff; **Winifrede Coal**; elevation, 2050′ B.

			Ft.	In.
Sandstone, shaly			5	0
Cannel bone	0′	2″		
Coal, medium-soft	1	8		
Bone	0	1	1	11
Slate, pavement				

Steven Bankhead Farm Mine—No. 232 on Map II.

On Grassy Creek, 0.7 mile east of Orndoff; **Winifrede Coal**; elevation, 2265′ B.

	Ft.	In.
Shale, dark, sandy	4	0
Coal, medium-soft	2	1
Slate, pavement	1	0
Sandstone, massive		

Winifrede Coal, Glade District.

In Glade District the Winifrede crops in the northwestern portion, next to Braxton and eastern Nicholas Counties, but in the central and southeastern portions its horizon is above the tops of the mountains. It has been prospected at only a few points, the following openings having been noted:

The **Morton and Skidmore Prospect (No. 233 on Map II)**, located on Camp Creek of Laurel Creek of Elk, 3.2 miles southeast of Prestonia, at an elevation of 1720′ B., appears to represent the Winifrede, the prospect having fallen shut and its thickness being reported as 1′ 6″.

The **A. F. Scott Prospect (No. 234 on Map II)**, located on Missouri Creek, 1.7 miles southwest of Erbacon, at an elevation of 1850′ B., had fallen shut, its thickness being reported as 3 feet.

Coal Exposure—No. 235 on Map II.

On Otterhole Run of Birch River, 1.8 miles southeast of Boggs; **Winifrede Coal**; elevation, 2030′ B.

		Ft.	In.
Sandstone, massive		30	0
Coal, splinty	0′ 10″		
Shale, gray	0 5		
Coal, splinty	0 11	2	2
Shale, gray			

Quantity of Winifrede Coal Available.

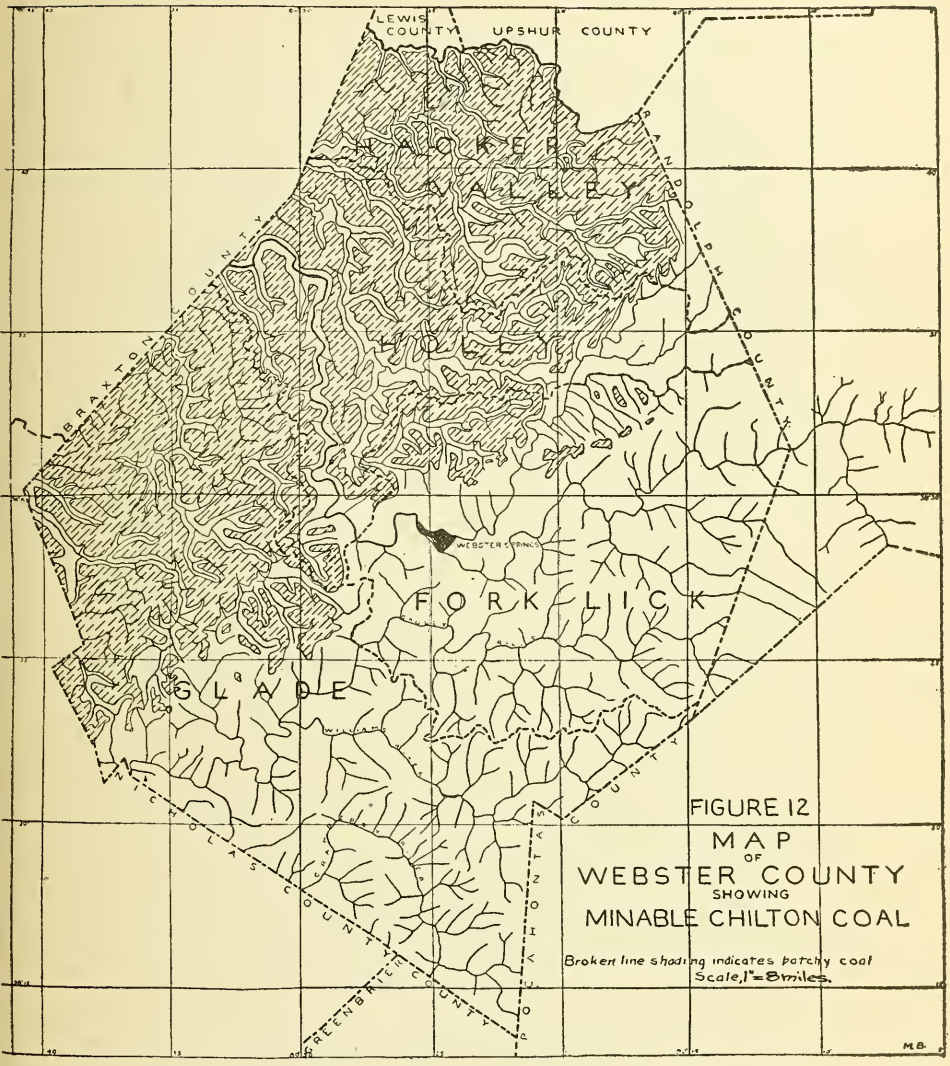
The following table, compiled by Miss Buchanan from a close estimate of the areal extent of the coal, as compared to the Stockton and Cedar Grove, the outcrops of which are shown on Map II, gives the probable amount of Winifrede Coal in the county, the average thickness assumed being purposely made low as an allowance for the patchy nature of the bed:

Probable Amount of Winifrede Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	1½	51.10	32,704	2,136,879,360	85,475,174
Holly	1½	45.70	29,248	1,911,064,320	76,442,573
Fork Lick	1½	8.50	5,440	355,449,600	14,217,984
Glade	1½	69.70	44,608	2,914,686,720	116,587,469
Totals		175.00	112,000	7,318,080,000	292,723,200

CHILTON COAL.

The Chilton Coal, previously discussed in Chapter VI, page 159, is found in the ridges of the northwestern half of the county, next to Upshur, Lewis, Braxton, and eastern Nicholas Counties, its horizon passing above the tops of the mountains in the southeastern half except in a few high summits. In the region of its occurrence it has been prospected and mined for local use at a few points, sometimes showing a thickness of 3 to 4 feet and in other regions being but poorly represented. Figure 12 shows its areal extent, the broken line shading indicating the patchy nature of its occurrence. Its outcrop is not shown on Map II, but its position at any point may be determined with reasonable accuracy from its relationship to the Cedar Grove and other coals, the outcrop of which is delineated, and the interval from which to the Chilton bed is exhibited in the Table of Intervals, pages 55 and 57.


LEWIS COUNTY
UPSHUR COUNTY
BRAXTON COUNTY
RANDOLPH COUNTY
NICHOLAS COUNTY
GREENBRIER COUNTY
POCAHONTAS COUNTY
WEBSTER SPRINGS
HOKE
KALEY
FORK LICK
GLADE
FIGURE 12
MAP
OF
WEBSTER COUNTY
SHOWING
MINABLE CHILTON COAL
Broken line shading indicates patchy coal
Scale, 1" = 8 miles.
M.B.

Chilton Coal, Hacker Valley District.

In Hacker Valley District the Chilton is poorly represented at the northern edge along the Upshur and Lewis County Lines, but in the southern end, next to Holly District, it has been opened at a few points. In the southeastern end, next to Randolph County, its horizon is above the tops of the mountains. The following openings have been noted:

The **Webster Cowger Farm Mine (No. 236 on Map II)**, located on Long Run of Left Fork of Holly River, 2.7 miles southeast of Poling, at an elevation of 1730′ B., measured 1′ 8″ of cannelly coal.

The **Jacob Groff Prospect (No. 237 on Map II)**, located on Middle Fork of Laurel Fork of Left Fork of Holly, 1.6 miles northwest of Penbro, at an elevation of 2330′ B., had fallen shut, its thickness being reported as 1′ 6″ to 2′ 0″.

Chilton Coal, Holly District.

In Holly District the Chilton crops in the ridges of the central and western portion, but in the eastern end, next to Randolph County, its horizon is above the tops of the mountains. It has been prospected at several points, at some of which it exhibits good, clean coal, the following openings having been noted:

The **George Young Farm Mine (No. 238 on Map II)**, located on a branch of Grassy Creek, 0.6 mile southwest of Water Station, at an elevation of 1825′ B., had partly fallen shut, 2 feet of coal being visible.

The **James Lewis Prospect (No. 239 on Map II)**, located on the same branch of Grassy Creek, just west of Water Station, had fallen shut, its thickness being reported as about 2′ 6″, and its elevation being 1825′ B.

The **J. W. Brooks Prospect (No. 240 on Map II)**, located on Grassy Creek, 0.3 mile northeast of Summit Station, at an elevation of 1927′ B., had fallen shut, the coal being reported 3 feet thick by the owner.

Farm Mine No. 241 on Map II, located on Desert Fork of Right Fork of Holly, 0.9 mile northward from Jumbo, at an elevation of 2152′ L., measured 2′ 8″ of clean coal.

The **Calvin Brady Farm Mine (No. 242 on Map II)**, located on Laurel Fork of Right Fork of Holly, 1.3 miles westward from Skelt, at an elevation of 2345′ B., had fallen shut, its thickness being reported as 4′ 5″ of rotten coal.

Another opening near-by had fallen shut, its section being reported as follows:

Calvin Brady Farm Mine—No. 243 on Map II.

On Laurel Fork of Right Fork of Holly River, 1.2 miles west of Skelt; Chilton Coal; elevation, 2365′ B.

			Ft.	In.
Coal, reported	1′	4″		
Slate, reported	0	1		
Coal, reported	1	1	2	6

The **Henry Hamrick Farm Mine (No. 244 on Map II)**, located on Laurel Fork of Right Fork of Holly River, 1.3 miles northwest of Skelt, at an elevation of 2285′ B., had fallen shut, the thickness of the coal being reported as 2′ 4″, without partings, by the owner.

The **Jonathan Bennett Prospect (No. 245 on Map II)**, located on a short branch of Elk River, 1 mile northeast of Tracy Switch, at an elevation of 2130′ B., had partly fallen shut, 1 foot of coal being visible and the remainder being concealed by mud.

Chilton Coal, Fork Lick District.

In Fork Lick District the Chilton crops mainly in the northern portion, next to the Holly District Line, its horizon elsewhere being above the mountain tops except in a few high summits. No prospects were observed.

Chilton Coal, Glade District.

In Glade District the Chilton crops in the western portion, next to Braxton and Nicholas Counties, but in the central and eastern portions its horizon is above the tops of the mountains. In the region of its occurrence it has been prospected at various points, the following openings having been noted:

Coal Prospect No. 246 on Map II, located on Missouri Creek of Laurel Creek of Elk, 1.5 miles southwest of Erbacon, at an elevation of 1785′ B., had fallen shut, its thickness not having been learned.

G. T. Harouf Farm Mine—No. 247 on Map II.

On Meadow Fork of Birch River, 2.1 miles west of Cowen; **Chilton Coal;** elevation, 2280′ B.

	Ft.	In.
Sandstone		
Slate, dark	1	0
Coal, soft	2	1
Slate, pavement		

Knight Tract Farm Mine—No. 248 on Map II.

On Back Fork of Birch River, 2.8 miles westward from Cowen; **Chilton Coal;** elevation, 2230′ B.

	Ft.	In.
Sandstone, massive		
Slate, dark	0	8
Coal, soft	2	1
Slate, pavement		

Cherry River Boom and Lumber Company Prospect—No. 249 on Map II.

On Back Fork of Birch River, 2.9 miles westward from Cowen; **Chilton Coal;** elevation, 2275′ B.

			Ft.	In.
Shale, dark			2	0
Coal, soft	1′	3″		
Slate, dark	0	2		
Coal, harder	0	8	2	1
Slate, pavement				

The coal has been stripped from the creek at **Prospect No. 250 on Map II,** located on the same fork of Birch, 2.9 miles westward from Cowen, at an elevation of 2260′ B., and it has been opened again at **Prospect No. 251 on Map II,** located on the same branch of Birch, 3 miles westward from Cowen, at an elevation of 2260′ B., both of these openings having fallen shut.

Coal Prospect—No. 252 on Map II.

On Sugar Camp Run of Strouds Creek, 1.2 miles westward from Strouds; **Chilton Coal**; elevation, 2240′ B.

	Ft.	In.
Shale, sandy, ferriferous	10	0
Slate, black	0	6
Coal, partly concealed by water, about	1	6

Quantity of Chilton Coal Available.

The following table, compiled by Miss Buchanan, gives a close estimate of the acreage of the Chilton, based on its relationship to the Peerless and other coals that are cropped on Map II. The assumed thickness of the coal is purposely made low to make allowance for the patchy nature of the bed, the final column showing the probable amount of commercial coal:

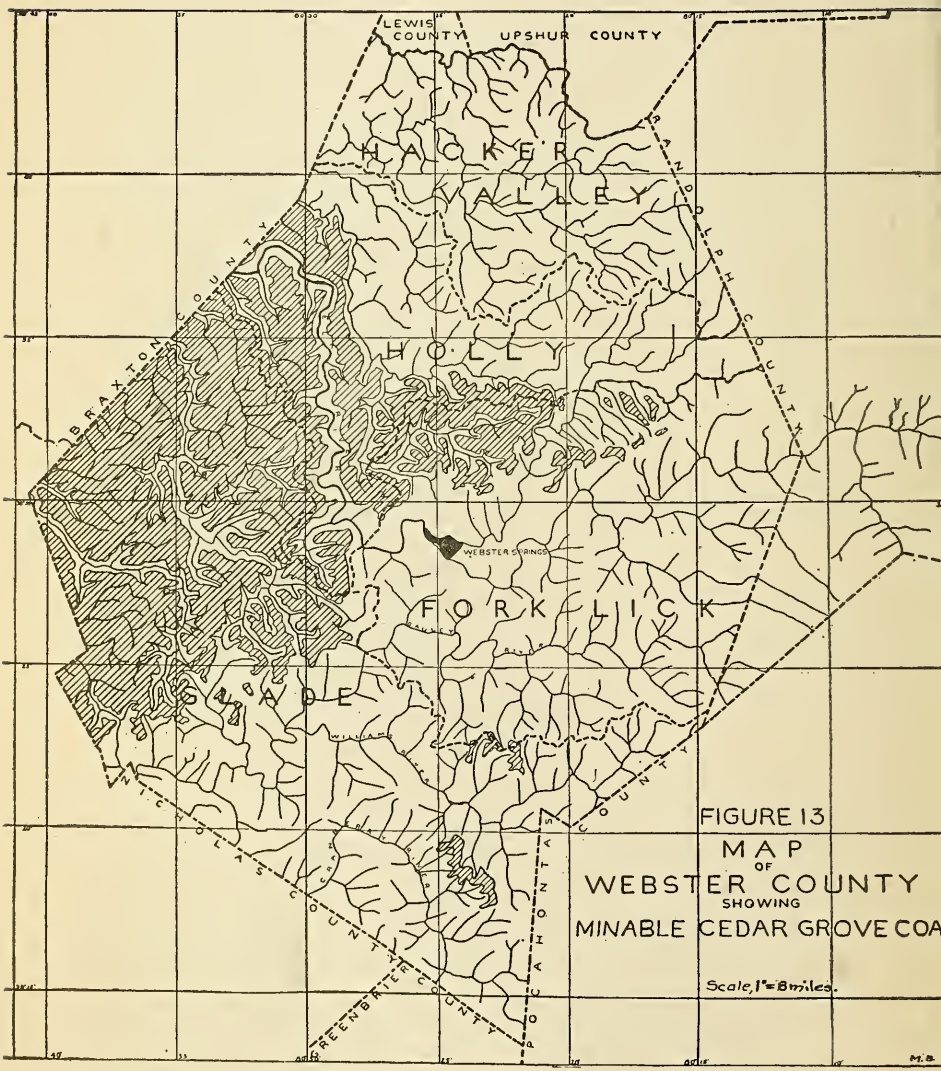
Probable Amount of Chilton Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	1½	53.50	34,240	2,237,241,600	89,489,664
Holly	2	49.15	31,456	2,740,446,720	109,617,869
Fork Lick	2	10.15	6,496	565,931,520	22,637,261
Glade	2½	74.85	47,904	3,130,047,360	125,201,894
Totals		187.65	120,096	8,673,667,200	346,946,688

CEDAR GROVE COAL.

The Cedar Grove Coal, previously discussed in Chapter VI, page 162, is of value mainly in the ridges of the southwestern portion of Holly, northwestern Fork Lick, and western Glade Districts. In the northern portion of the county, comprising Hacker Valley and northern Holly Districts, it seems to be almost totally absent, and in the southeastern half, comprising portions of Fork Lick and Glade Districts, its horizon is above the mountain tops except in a few of the very high summits. Figure 13 shows its areal extent in the

region where it is known or believed to be of minable thickness and fairly persistent in its occurrence, its thickness in this portion of the county being 2 to 4 feet, and on Map II its outcrop is delineated for the corresponding region.



Cedar Grove Coal, Holly District.

In Holly District the Cedar Grove is of value principally in the southwestern edge, south of the Right Fork of Holly River and next to Glade and Fork Lick Districts, as indicated on Figure 13, the following openings having been noted:

The **W. G. Bennett Prospect (No. 253 on Map II)**, located on Oldlick Creek, 2.4 miles southwest of Hodam, at an elevation of 1875′ B., had fallen shut, the thickness of the coal being reported at 2′ 2″.

In the vicinity of Summit Station the coal has been mined on a semicommercial basis for several years, the following mine, now abandoned, being the first of these operations:

G. W. Curtin Heirs Mine (J. W. Brooks Opening)—No. 254 on Map II.

On Grassy Creek, 0.3 mile northeast of Summit Station; **Cedar Grove Coal**; elevation, 1915′ B.

			Ft.	In.
Slate, dark				
Cannel, bone	0′	8″		
Coal, medium-hard	3	6	4	2
Slate, pavement				

The following mine, located on the West Virginia Midland Railroad, is in active operation:

J. W. Brooks Mine—No. 255 on Map II.

On Grassy Creek, 0.1 mile northeast of Summit Station; **Cedar Grove Coal**; elevation, 1910′ B.

			Ft.	In.
1. Sandstone, shaly				
2. Slate, black, cannel bone	0′	10″		
3. **Coal**, medium-hard	3	8		
4. Sulphur band	0	2	4	8
5. Slate, pavement				

A sample (No. 238R, see also No. 171R) was collected from No. 3 of section, the composition of which is published under **Mine No. 255** in the Survey Table of Coal Analyses at

the end of this Chapter. According to Mr. Brooks the mine has an output of 500 bushels (20 tons) daily, the coal being used for steam fuel on the West Virginia Midland Railroad and for domestic purposes along the same line of traffic, 5 miners being employed. The output is secured by pick mining, there being no mechanical equipment in the mine other than a siphon device to remove the water, the main entry being made on the dip.

The **Strange Riffle Prospect (No. 256 on Map II)**, located on Right Fork of Holly River, 1.1 miles southeast of Jumbo, at an elevation of 1925′ B., had fallen shut, the thickness of the coal being reported as 2 feet by the owner.

The **M. P. Brooks Prospect (No. 257 on Map II)**, located on Right Fork of Holly, opposite the mouth of Laurel Fork, and 2.2 miles southeast of Jumbo, at an elevation of 2080′ B., had fallen shut, the thickness of the coal being reported as 0′ 8″ by the owner.

West Virginia Midland Railroad Exposure—No. 258 on Map II.

On the north side of Elk River, 0.3 mile southwest of Summit Station; **Cedar Grove Coal**; elevation, 1920′ B. .

			Ft.	In.
Sandstone, massive			6	0
Shale, gray			0	6
Coal	0′	10″		
Slate, black	0	2		
Coal	0	6		
Slate, dark	0	8		
Coal	0	2	2	4
Fire clay shale			4	0
Sandstone, massive, to grade			7	0

West Virginia Midland Railroad Exposure—No. 259 on Map II.

On the north side of Elk River, 0.4 mile southwest of Summit; **Cedar Grove Coal**; elevation, 1910′ B.

	Ft.	In.
Concealed		
Coal	1	6
Fire clay shale	2	0
Sandstone, shaly	10	0

			Ft.	In.
Coal	0′	9″		
Slate, black	0	6		
Coal	0	5	1	8
Fire clay shale				

At the **West Virginia Midland Railroad Exposure (No. 260 on Map II)**, located on the north side of Elk River, 0.6 mile southwest of Summit Station, the coal exhibits an estimated thickness of 2½ feet, at an elevation of 1933′ B., coming 11 feet above the top of the Lower Cedar Grove which is also visible in the same cut.

The **W. B. Tracy Prospect (No. 261 on Map II)**, located on the south side of Elk River, 1.2 miles southwest of Tracy Switch, at an elevation of 2145′ B., had fallen shut, the thickness of the coal not being learned.

The **Jonathan Bennett Prospect (No. 262 on Map II)**, located on Mill Run of Elk River, 0.4 mile northeast of Tracy Switch, measured 1′ 9″ of clean, soft coal, at an elevation of 2035′ B.

Cedar Grove Coal, Fork Lick District.

In Fork Lick District the Cedar Grove occurs in the ridges along the northern edge next to the Holly District Line, but has been opened at only a few points, the only opening noted being the **W. H. Hamrick Farm Mine (No. 263 on Map II)**, located on Grassy Creek, 1.2 miles northeast of Kovan, at an elevation of 2265′ B., its thickness being reported as 3 feet.

Cedar Grove Coal, Glade District.

In Glade District the Cedar Grove crops over the western portion, next to Braxton and eastern Nicholas Counties, but in the central and southeastern portion its horizon is above the mountain tops except in a few high ridges along the Kovan Syncline. It has been prospected at several points, the following openings having been noted:

The **Walter Boswell Prospect (No. 264 on Map II)**, located on Laurel Creek of Elk, 1 mile south of Defoe, at an

elevation of 1650′ B., had fallen shut, but according to information supplied to Ray V. Hennen by Noah Barnett, the coal measured 2′ 6″, being of the bastard cannel variety.

W. L. McCoy Prospect—No. 265 on Map II.

On Birch River, 1 mile northwest of Boggs; **Cedar Grove Coal;** elevation, 1725′ B.

		Ft.	In.
Shale, dark			
Coal, bony, with streak of cannel at top	1′ 3″		
Coal, soft	1 4	2	7
Slate, pavement			

The **Margaret Strange Prospect (No. 266 on Map II),** located on a branch of Barnet Run of Birch River, 0.8 mile southwest of Boggs, measured 1′ 4″, with an elevation of 1805′ B.

The **Wyatt Justus Prospect (No. 267 on Map II),** located on Birch River, 1 mile southeast of Boggs, at an elevation of 1850′ B., had fallen shut, its thickness not being learned.

The **Albert Gardner Prospect (No. 268 on Map II),** located on a branch of Big Ditch Run of Gauley River, 1.4 miles southwest of Cowen, at an elevation of 2300′ B., had fallen shut, its thickness being reported as 1′ 2″.

What appears to be the Cedar Grove Coal crops in the public road at Coal Exposure **No. 269 on Map II,** located at the Pleasant Ridge School, 2 miles southwest of Bolair, at an elevation of 2655′ B.

Quantity of Cedar Grove Coal Available.

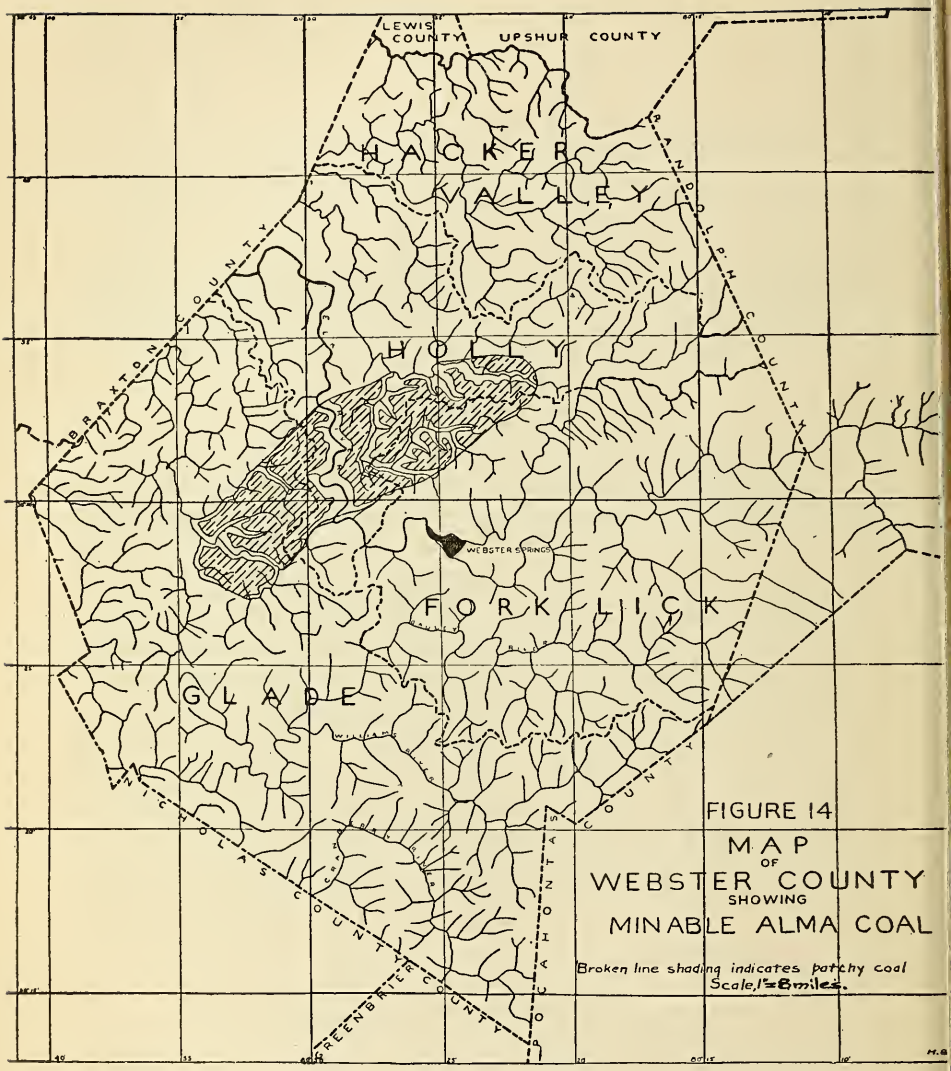
The following table, compiled by Miss Buchanan from a planimetric measurement of the outcrop, gives the probable amount of Cedar Grove Coal in that portion of the county indicated by Figure 13 as containing it in minable quantity:

Probable Amount of Cedar Grove Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Holly	3	26.90	17,216	2,249,786,880	89,991,475
Fork Lick	2	11.50	7,360	641,203,200	25,648,128
Glade	2	82.25	52,640	4,585,996,800	183,439,872
Totals		120.65	77,216	7,476,986,880	299,079,475

ALMA COAL.

The Alma Coal, previously discussed in Chapter VI, page 164, appears to be of value mainly in a limited area lying northwest of the center of the county, and comprising portions of Holly, Fork Lick, and Glade Districts. Its horizon belongs over most of the northwestern half of the county but in a considerable portion of this area no prospects were found. Figure 14 shows its areal extent for the region outlined above, the patchy nature of its occurrence being indicated by broken line shading. Its thickness varies from 2 to 3 feet at such prospects as were noted. Its outcrop is not shown on Map II, but its position may be determined closely for any particular point from its relationship to the Campbell Creek (Peerless Bench) Coal, as exhibited in the Table of Intervals, pages 55 and 57.



Alma Coal, Hacker Valley District.

In Hacker Valley District the Alma appears to be represented only along the southern edge. At the **Mayton Lumber Company Exposure (No. 273 on Map II)**, located on a branch of Hodam Creek, 0.9 mile west of Hodam village, it measured

PLATE XXIV.—View of Erbacon on Laurel Creek; Topography of Pottsville Series.

1′ 4″, at an elevation of 1960′ B. At the **Everett Hamrick Prospect (No. 274 on Map II)**, located on main Hodam Creek, 0.3 mile west of Hodam village, the coal was reported to have measured 1′ 4″, its elevation being 2035′ B.

Alma Coal, Holly District.

In Holly District the following prospects were noted in the Alma:

The **Laura Brooks Farm Mine (No. 275 on Map II)**, located on Grassy Creek, 0.2 mile southeast of Summit Station, measured 2′ 8″ of clean, medium-hard coal, at an elevation of 1885′ B.

Benjamin Westfall Farm Mine—No. 276 on Map II.

On Grassy Creek, 0.6 mile southeast of Summit Station; **Alma Coal**; elevation, 1920′ B.

			Ft.	In.
Shale, sandy				
Coal, cannel, slightly bony	0′	5″		
Coal, medium-soft	1	8		
Bone	0	2	2	3

The coal was once opened at the **Strange Riffle Prospect (No. 277 on Map II)**, located on Right Fork of Holly River, 1.1 miles southeast of Jumbo at an elevation of 1890′ B., but had fallen shut, its thickness not being learned.

The **M. P. Brooks Prospect (No. 278 on Map II)**, located on Right Fork of Holly River, 2.2 miles southeast of Jumbo, at an elevation of 2040′ B., had fallen shut, the thickness of the coal being reported as 1′ 2″ by the owner, as exhibited in the section for Laurel Fork of Holly, page 85.

Alma Coal, Fork Lick and Glade Districts.

In Fork Lick District no prospects were noted at the Alma horizon, its position being well up toward the tops of the mountains.

In Glade District the two following openings were observed:

The **George Eagle Prospect** (No. 279 on Map II), located on Road Fork of Lost Run of Laurel Creek of Elk River, 1.3

miles east of Weese, at an elevation of 1985′ B., had fallen shut, and could not be measured.

The **Ellis Weese Prospect (No. 280 on Map II)**, located on Lost Run of Laurel Creek, 1.5 miles northeast of Weese, at an elevation of 1930′ B., measured 1′ 11″ of clean, soft coal.

Quantity of Alma Coal Available.

The following table, compiled by Miss Buchanan from a close estimate of the acreage as compared with the Campbell Creek (Peerless Bench) Coal, lying a short distance below, gives the probable amount of Alma Coal in that portion of the county indicated on Figure 14 as containing it in minable thickness:

Probable Amount of Alma Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Holly	1.5	10.70	6,848	447,448,320	17,897,933
Fork Lick	1.5	5.90	3,776	246,723,840	9,868,954
Glade	1.5	11.10	7,104	464,175,360	18,567,014
Totals		27.70	17,728	1,158,347,520	46,333,901

CAMPBELL CREEK (PEERLESS BENCH) COAL.

The Campbell Creek (Peerless Bench) Coal, previously discussed in Chapter VI, page 166, has been widely prospected and mined for local domestic fuel over the northwestern half of the county, and has been mined commercially on a small scale. It is one of the most persistent coals of the Kanawha Group, its thickness varying from 2 to 4 feet, and as its quality is uniformly good it is an asset of great intrinsic value to those districts in which it is found. Its outcrop is shown on Map II and its areal extent is exhibited on Figure 15.

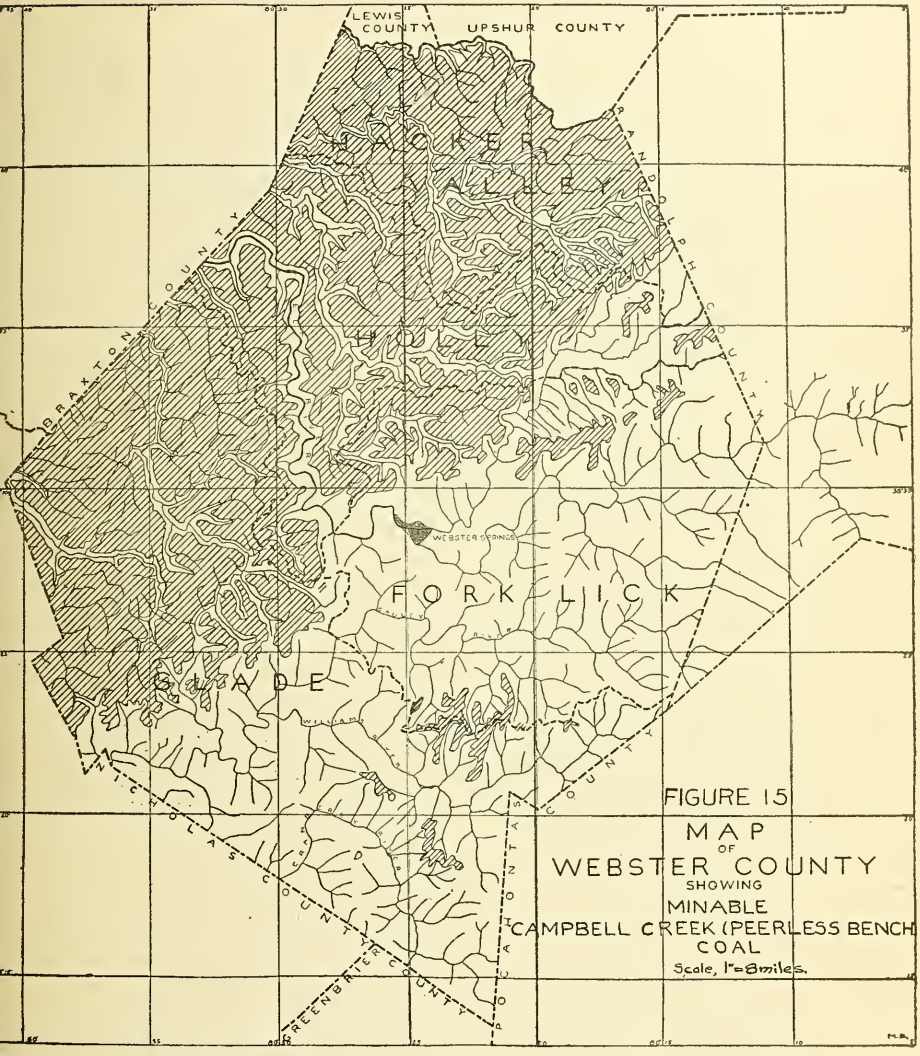


FIGURE 15

MAP OF WEBSTER COUNTY SHOWING MINABLE CAMPBELL CREEK (PEERLESS BENCH) COAL

Scale, 1"=8miles.

Campbell Creek (Peerless Bench) Coal, Hacker Valley District.

In Hacker Valley District the Peerless has been prospected at various points, mainly on the waters of Left Fork of Holly River, the following openings having been noted:

The **Mayton Lumber Company Prospect (No. 281 on Map II)**, located on a branch of Left Fork of Holly, 0.9 mile westward from Hodam, at an elevation of 1915′ B., had fallen shut, its thickness not being learned.

The following opening had fallen shut, its section being reported by Ballard Carpenter:

Everett Hamrick Prospect—No. 282 on Map II.

On Hodam Creek, 0.4 mile westward from Hodam village; Peerless Coal; elevation, 1990′ B.

			Ft.	In.
Coal	1′	6″		
Slate	1	6		
Coal	1	6	4	6

The **John T. McGraw Farm Mine (No. 283 on Map II)**, located on Hodam Creek, 1.4 miles southwest of Hodam village, at an elevation of 2060′ B., had partly fallen shut, there being 2 feet of coal visible. According to J. P. White, who formerly used coal from this opening in the lumber camps of the neighborhood, the seam measured 2′ 8″ to 3′ 0″ of clean coal.

The **James Pudder Farm Mine (No. 284 on Map II)**, located on Hacker Lick Run of Left Fork of Holly, 1 mile southeast of Hacker Valley, with an eleavtion of 1765′ B., measured 2′ 5″ of clean, medium-hard coal. The **James Pudder Farm Mine (No. 285 on Map II)**, located on the same stream, 1.2 miles southeast of Hacker Valley, and having the same elevation, measured 2′ 6″ of the same kind of coal.

Coal Prospect—No. 286 on Map II.

On Left Fork of Holly River, 0.6 mile southeast of Hacker Valley; **Peerless Coal**; elevation, 1760′ B.

			Ft.	In.
Sandstone, massive			5	0
Coal, medium-soft	2′	1″		
Coal, splinty	0	9	2	10
Slate, pavement				

The **Henry Anderson Farm Mine (No. 287 on Map II)**, located on Left Fork of Holly, 2.8 miles southeast of Hacker Valley, at an elevation of 1865′ B., had fallen shut, the coal being reported as 3′ 0″ with a slate parting near the middle.

Homer Bickle Farm Mine—No. 288 on Map II.

On Straight Fork of Fall Run of Left Fork of Holly, 2.4 miles southeast of Penbro; **Peerless Coal**; elevation, 2825′ B.

			Ft.	In.
Coal, soft?	1′	2″		
Coal, hard, bony?	0	2		
Coal, medium-soft	2	2		
Coal, hard, splinty	0	3	3	9
Slate, pavement				

The coal at this point had been mined by stripping, and as the top was partly weathered out the physical character of the upper portion is somewhat doubtful.

Oliver Williams Farm Mine—No. 289 on Map II.

On the ridge south of Little Sugar Creek, 0.8 mile southwest of Pisgah Knob and 4 miles southwest of Pickens; **Peerless Coal**; elevation, 3065′ B.

			Ft.	In.
1. Slate, dark				
2. **Coal**, hard, splint	0′	4″		
3. **Coal**, medium-soft	2	0	2	4
4. Slate, pavement				

A sample (No. 215R) was collected from this opening, the composition of which is published under **Mine No. 289** in the Survey Table of Coal Analyses at the end of this Chapter.

Campbell Creek (Peerless Bench) Coal, Holly District.

In Holly District the Peerless Coal has been prospected at various points on Right Fork of Holly, and in several localities in the Elk Valley, the following openings having been noted:

The **Hardy Crow Farm Mine (No. 290 on Map II)**, located on Oldlick Creek, 1 mile southeast of Marpleton, at an elevation of 1110′ B., measured 2′ 4″ of clean, medium-hard coal.

The **Ezekiel Marple Farm Mine (No. 291 on Map II)**, located on Oldlick Creek, 1.2 miles southeast of Marpleton, measured 2′ 6″ of clean, hard, splinty coal, its elevation being 1125′ B.

Ezekiel Marple Farm Mine—No. 292 on Map II.

On Oldlick Creek of Left Fork of Holly, 1.6 miles southeast of Marpleton; **Peerless Coal**; elevation, 1155′ B.

			Ft.	In.
Shale, dark, sandy			10	0
Coal, soft	1′	9″		
Coal, hard, splinty	1	2	2	11
Slate, pavement				

The **Thomas Perky Farm Mine (No. 293 on Map II)**, located on Right Fork of Holly, 0.9 mile northwest of Fishers Crossing, at an elevation of 1220′ B., had fallen shut, the thickness of the coal not being learned.

The **R. F. Tanner Farm Mine (No. 294 on Map II)**, located on Right Fork of Holly, 0.9 mile northward from Big Run Station, had partly fallen shut, there being 2 feet of cannelly coal visible, at an elevation of 1490′ B.

The **R. F. Tanner Farm Mine (No. 295 on Map II)**, located on Right Fork of Holly, 0.8 mile northward from Big Run Station, at an elevation of 1500′ B., measured 3′ 0″ of cannel coal, as exhibited in the section for Big Run, page 80.

Dale Williams Farm Mine—No. 296 on Map II.

On Mudlick Run of Right Fork of Holly River, 1.2 miles southwest of Jumbo; Peerless Coal; elevation, 2075′ B.

			Ft.	In.
Shale, dark				
Coal, hard, blocky	0′	3″		
Coal, medium-soft	2	2		
Coal, hard, bony	0	3	2	8
Slate, pavement				

The Adam Clifton Farm Mine (No. 297 on Map II), located on Mudlick Run of Right Fork of Holly, 1.3 miles southwest of Jumbo, measured 2′ 6″ clean, medium-soft coal, its elevation being 2085′ B.

The Currence Chapman Farm Mine (No. 297A on Map II), located on Right Fork of Holly, just south of Jumbo, at an elevation of 2035′ B., was partly filled with water and mud, its apparent thickness being about 2′ 6″.

The John T. McGraw Prospect (No. 298 on Map II), located on Desert Fork of Right Fork of Holly, 1.5 miles northeast of Jumbo, was partly filled with water, the coal appearing to be about 1′ 6″ thick, with an elevation of 1995′ B.

John T. McGraw Prospect (Bias Cogar Opening)—No. 299 on Map II.

On Desert Fork of Right Fork of Holly River, 2.7 miles northeast of Jumbo; Peerless Coal; elevation, 2010′ B.

			Ft.	In.
1. Slate, dark				
2. Coal	0′	6″		
3. Slate, gray	2	3		
4. Coal, soft	2	8	5	5
5. Slate, bony			0	6
6. Shale, gray				

A sample (No. 174R) was collected from No. 4 of section the composition of which is published under Mine No. 299 in the Survey Table of Coal Analyses at the end of this Chapter.

Strange Riffle Prospect—No. 300 on Map II.

On Right Fork of Holly River, 1 mile southeast of Jumbo; Peerless Coal; elevation, 1825′ B.

			Ft.	In.
Slate, black				
Coal	0′	10″		
Slate and concealed	3	0		
Coal, cannel	1	0	4	10

In the above section, the two lower members were concealed, the measurements being reported by a resident.

The M. P. Brooks Prospect (No. 301 on Map II), located on Right Fork of Holly opposite the mouth of Laurel Fork and 2.2 miles southeast of Jumbo, at an elevation of 2010′ B., had fallen shut, its thickness being reported by the owner as 5′ 5″ with a two-foot slate parting in the middle, as exhibited in the section for Laurel Fork of Holly, page 85.

The Preston Carpenter Farm Mine (No. 302 on Map II), located on Right Fork of Holly, 3.1 miles southeast of Jumbo, measured 2′ 10″ of clean, soft coal, with an elevation of 2175′ B.

Farm Mine—No. 303 on Map II.

On Right Fork of Holly River, 3.1 miles southeast of Jumbo; Peerless Coal; elevation, 2150′ B.

			Ft.	In.
Slate				
Coal, soft	0′	6″		
Coal, hard	0	2		
Coal, soft	1	10	2	6
Slate, pavement				

In that portion of Holly District which extends southward into the valley of Elk River, the coal was once mined at a small railroad operation that has now been abandoned, the following section having been obtained near the mouth of the old mine:

Oscar Marsh Mine—No. 304 on Map II.

On Elk River, along the West Virginia Midland Railroad, 1 mile southwest of Summit Station; Peerless Coal; elevation, 1880′ B.

	Ft.	In.
Coal blossom		
Concealed and dark slate	6	0
Coal	2	5
Slate, pavement		

In that portion of the Elk drainage embraced by Holly District east of Webster Springs, several openings have been made, the following having been noted:

At **Coal Exposure No. 305 on Map II,** located on the ridge road between Sugar Creek and Little Sugar Creek, 2.8 miles northeast of the present location of Skelt post-office, the coal is visible at an elevation of 3075′ B., its blossom measuring 2′ 0″.

Farther northeast along the same ridge it was once opened at the **Samuel Thomas Farm Mine (No. 306 on Map II),** located 3.9 miles northeast of Skelt, at an elevation of 3045′ B., the thickness of the coal not being learned.

The **Samuel Wilkins Farm Mine (No. 307 on Map II),** located on the same ridge, 4.1 miles northeast of Skelt, at an elevation of 3025′ B., had fallen shut, the coal being reported as slightly less than 2 feet thick.

Campbell Creek (Peerless Bench) Coal, Fork Lick District.

In Fork Lick District the Peerless Coal has been prospected at several points along the Elk drainage east of Webster Springs, as well as in that portion of Grassy Creek embraced in the district, the following openings having been noted:

The **Thomas Bender Farm Mine (No. 307A on Map II),** located on Little Grassy Creek, 1.9 miles southward from Orndoff, at an elevation of 2291′ B., had partly fallen shut, its total thickness being reported as 4′ 0″, as detailed in the section for Little Grassy Creek, page 94.

What appears to be the Peerless was once opened at the **G. W. Miller Prospect (No. 308 on Map II),** located at the head of Bear Run of Back Fork of Elk, 2.4 miles northeast of Webster Springs, at an elevation of 2725′ B., its thickness being reported by the owner as 1′ 3″ of clean coal.

George H. Miller Mine—No. 309 on Map II.

On Back Fork of Elk, 1.3 miles northward from Breece; **Peerless Coal**; elevation, 2420′ B.

			Ft.	In.
Slate, dark				
Coal, soft	0′	8″		
Slate, bony	0	1		
Coal, soft	3	5	4	2
Slate, pavement				

Coal from this opening formerly furnished fuel for the hoisting engine of an inclined timber tramroad that was once operated across the mountain at a near-by point. A sample (No. 20) was collected from this mine by D. D. Teets, Jr., the composition of which is published under **Mine No. 309** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Scott Clifton Farm Mine—No. 310 on Map II.

On the Back Fork of the Elk River, 1.6 miles southwest of the present location of Skelt Post-Office; **Peerless Coal**; elevation, 2460′ B.

			Ft.	In.
Shale, dark, sandy			5	0
Coal, medium-soft	1′	0″		
Slate, black	0	0½		
Coal, medium-soft	0	9½	1	10
Slate, pavement				

John Gregory Farm Mine—No. 311 on Map II.

On Point Mountain at Woodzell, near the head of Baltimore Run of Elk River; **Peerless Coal**; elevation, 3015′ B.

			Ft.	In.
Shale, dark			5	0
Coal, medium-soft	1′	3″		
Bone	0	1		
Coal, medium-hard	2	1	3	5
Slate, pavement				

A sample (No. 19) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 311** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The coal was once opened at the William Wooddell Prospect (No. 312 on Map II), located on Point Mountain at the head of Potato Knob Run of Back Fork of Elk, 1.2 miles northeast of Woodzell, at an elevation of 3190′ B., but the opening had fallen shut and its thickness was not learned.

Coal Prospect—No. 313 on Map II.

On Point Mountain at the head of Grandaddy Run of Elk River, 1.3 miles eastward from Woodzell; Peerless Coal; elevation, 3195′ B.

			Ft.	In.
Slate, dark				
Coal	1′	8″		
Coal, bony	0	2		
Coal	0	6	2	4
Slate, pavement				

Campbell Creek (Peerless Bench) Coal, Glade District.

The Peerless Coal has been widely prospected for local fuel and has been mined commercially to a limited extent in Glade District, principally on the waters of Laurel Fork of Elk River, although several openings have been made on the waters of Birch and Gauley Rivers. On Laurel Creek and its tributaries the following openings were noted:

The following opening is located in Holly District, Braxton County, about one-eighth mile from the Webster line:

Reece & McCabe Prospect—No. 314 on Map II.

On Laurel Creek opposite Prestonia; Peerless Coal; elevation, 1130′ B.

	Ft.	In.
Shale, sandy	25	0
Coal, bony cannel	6	4
Slate, pavement		

A sample (No. 894H) was taken from this opening by Ray V. Hennen, the composition of which is published under Mine No. 314 in the Survey Table of Coal Analyses, the same having been previously published in the Braxton and Clay Report of the Survey, page 776 (listed as Mine No. 945 in that

volume), where the coal was doubtfully classified as the Cedar Grove. Another sample (No. 39) was collected by D. D. Teets, Jr., the composition of which is published under **Mine No. 314** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter. Both analyses show the coal to be very high in ash.

At the **Baltimore and Ohio Railroad Exposure (No. 315 on Map II)**, located on Laurel Creek, 0.3 mile southeast of Prestonia, at an elevation of 1180′ B., about 2 feet of coal is exposed at the same horizon, the cannel structure having disappeared.

At **Coal Prospect No. 316 on Map II**, located on Laurel Creek, 0.9 mile northeast of Erbacon, the Peerless was once opened at an elevation of 1550′ B., but the place had fallen shut and could not be measured.

At **Coal Exposure No. 317 on Map II**, located on Missouri Creek, 0.3 mile west of Erbacon, the coal is visible at an elevation of 1565′ B., measuring about 2 feet at the outcrop.

At **Coal Opening No. 318 on Map II**, located on the right branch of Missouri Creek, 0.7 mile southwest of Erbacon, the coal measured slightly less than 2 feet, its elevation being 1605′ B.

Coal Opening No. 319 on Map II, located on Missouri Creek, 0.7 mile southwest of Erbacon, at an elevation of 1600′ B., had fallen shut and its thickness was not learned.

At the **S. M. Smith Farm Mine (No. 320 on Map II)**, located on Missouri Creek, 1 mile southwest of Erbacon, the coal had been mined by stripping. The pit was full of water, there being a thickness of about 2 feet, with an elevation of 1665′ B.

Robert Rollins Farm Mine—No. 321 on Map II.

On Laurel Creek, 0.2 mile southward from Erbacon; **Peerless Coal**; elevation, 1610′ B.

			Ft.	In.
Sandstone, massive				
Coal	0′	9″		
Slate, black	0	8		
Coal	1	0	2	5
Concealed by water				

At **Coal Prospect No. 322 on Map II,** located 0.6 mile southward from Erbacon, the coal measured 2 feet in thickness, with an elevation of 1645′ B., as exhibited in the section for Erbacon, page 108.

At the **Wainville Coal & Coke Company Prospect (No. 323 on Map II),** located on Laurel Creek, 0.8 mile southward from Erbacon, the coal had not been faced up at the time of the writer's visit, but at a later date it was reported to have shown 2 to 3 feet of coal, its elevation being 1655′ B. At this point preparations were under way to open a commercial mine but the project has been temporarily abandoned.

Farm Mine—No. 324 on Map II.

On Laurel Creek, 1.2 miles southeast of Erbacon; **Peerless Coal;** elevation, 1670′ B.

			Ft.	In.
Sandstone, massive				
Shale, dark			1	0
Coal, soft	1′	0″		
Coal, splinty	0	10		
Coal, soft	0	9	2	7
Slate, pavement				

Farm Mine—No. 325 on Map II.

On Laurel Creek, 1.3 miles southeast of Erbacon; **Peerless Coal;** elevation, 1690′ B.

			Ft.	In.
Sandstone, shaly			10	0
Coal, soft	1′	2″		
Coal, splinty	0	5		
Coal, soft	1	1	2	8
Slate, pavement				

The **Jacob Weese Farm Mine (No. 326 on Map II),** located on Road Fork of Lost Run of Laurel Creek, 1.2 miles eastward from Weese, at an elevation of 1940′ B., had partly fallen shut, the coal being estimated as about 2 feet thick.

The **Jacob Weese Farm Mine (No. 327 on Map II),** located on the same tributary, 1.3 miles eastward from Weese, measured 2′ 4″ of clean, soft coal, with an elevation of 1945′ B.

The **George Eagle Farm Mine (No. 328 on Map II),** lo-

cated on the same tributary, 1.5 miles eastward from Weese, measured 2′ 2″ of clean, soft coal, with an elevation of 1960′ B.

The **John Weese Farm Mine (No. 329 on Map II)**, located on Lost Run, 1.1 miles northeast of Weese, at an elevation of 1805′ B., had fallen shut, its thickness being reported as about 2 feet.

The **D. P. Kessler Farm Mine (No. 330 on Map II)**, located on Laurel Creek, 0.5 mile southeast of Weese, at an elevation of 1850′ B., had fallen shut, the thickness of the coal being reported by the owner as 2′ 6″ to 2′ 8″.

A commercial operation just being started by the Laurel Hill Mining Company, Continental Building, Baltimore, Md., at the time of the writer's visit, revealed the two following sections of the coal, the same not being driven under cover far enough for sampling:

Laurel Hill Mining Company (Main Opening) Mine—No. 331 on Map II.

On Laurel Creek, at Hardwood Siding, 0.6 mile westward from Arcola; **Peerless Coal**; elevation, 1996′ B.

	Ft.	In.
Soil		
Coal, soft	2	3
Slate, pavement		

Laurel Hill Mining Company (West Opening) Mine No. 332 on Map II.

On Laurel Creek, at Hardwood Siding, 0.7 mile westward from Arcola; **Peerless Coal**; elevation, 1995′ B.

	Ft.	In.
Slate, dark	5	0
Coal, soft	2	1
Slate, pavement		

The **D. P. Kessler Farm Mine (No. 333 on Map II)**, located on Laurel Creek, 0.7 mile northwest of Arcola, measured 2′ 4″ of clean, medium-soft coal, with an elevation of 1965′ B.

At the following opening the coal has been mined commercially on a small scale for several years:

Arcola Coal Company Mine—No. 334 on Map II.

On Laurel Creek at Arcola; **Peerless Coal**; elevation, 2025′ B.

	Ft.	In.
Slate, dark		
Coal, soft, columnar	2	2
Slate, dark, pavement		

"Principal office, Clarksburg, W. Va.; daily capacity, 25 tons; 5 to 6 men employed; sample (No. 183R) collected in Second Right off Main Entry by D. B. Reger; Cornelius Tharp, acting mine foreman, authority for data; C. E. Pool, General Manager."

The composition of this sample is published under **Mine No. 334** in the Survey Table of Coal Analyses at the end of this Chapter. The analysis of the sample reveals a very pure coal, high in volatile matter and low in ash, sulphur, and phosphorus.

The **O. B. Miller Farm Mine (No. 335 on Map II)**, located on a short branch of Laurel Creek, 0.5 mile westward from Jack, measured 2′ 0″ of clean coal, with an elevation of 2060′ B.

On McAvoy Run the Smoot Lumber Company has operated the coal on a considerable scale for use on its logging locomotives as well as for the domestic use of its employees, there being four openings, part of which are not now in use. The **Smoot Lumber Company Mine (No. 336 on Map II)**, located on McAvoy Run of Laurel Creek, 1.2 miles southeast of Jack, measured 2′ 4″ of clean, soft coal, at an elevation of 2095′ B. The **Smoot Lumber Company Mine (No. 337 on Map II)**, located on the same stream, 1.2 miles southeast of Jack, measured 2′ 5″ of clean, soft coal, with an elevation of 2100′ B. The **Smoot Lumber Company Mine (No. 338 on Map II)**, located on the same tributary, 1.3 miles southeast of Jack, measured 2′ 4″ of clean, soft coal, its elevation being 2105′ B. The following opening is in active operation:

Smoot Lumber Company Mine—No. 339 on Map II.

On McAvoy Run of Laurel Creek, 1.3 miles southeast of Jack; **Peerless Coal**; elevation, 2115′ B.

	Ft.	In.
1. Sandstone, massive		
2. **Coal**, soft	2	5
3. Slate, pavement		

At the time of the writer's visit the mine was putting out 100 bushels daily, there being one miner employed. A sample (No. 192R) was collected from No. 2 of section, the composition of which is published under **Mine No. 339** in the Survey Table of Coal Analyses at the end of this Chapter. The analysis shows a coal low in sulphur and phosphorus and unusually low in ash.

Farm Mine No. 340 on Map II, located on McAvoy Run, 2.1 miles northwest of Bolair, had partly fallen shut, its apparent thickness being about 2′ 6″, reported clean coal, with an elevation of 2305′ B.

John Moffat Farm Mine—No. 341 on Map II.

On a short branch of Given Run of Laurel Creek, 1.6 miles eastward from Marcus; **Peerless Coal;** elevation, 2180′ B.

	Ft.	In.
Sandstone, massive		
Slate, interlaminated with streaks of **coal**	1	0
Coal, soft	2	0
Slate, pavement		

The J. A. Miller Heirs Farm Mine (No. 342 on Map II), located on the same branch of Given Run, 1.8 miles eastward from Marcus, measured 2′ 0″ of clean, soft coal, at an elevation of 2195′ B.

The J. A. Miller Heirs Farm Mine (No. 343 on Map II), located on the same branch of Given Run, 2 miles eastward from Marcus, measured 1′ 6″ of clean, soft coal, at an elevation of 2210′ B.

Baltimore and Ohio Railroad Exposure—No. 344 on Map II.

On Laurel Creek, 0.3 mile northeast of Marcus; **Peerless Coal;** elevation, 2060′ B.

	Ft.	In.
Shale, sandy		
Coal, cannelly	1	6
Sandstone, shaly, to grade	35	0

Baltimore and Ohio Railroad Exposure—No. 345 on Map II.

On Laurel Creek, 0.1 mile eastward from Marcus; **Peerless Coal;** elevation, 2085′ B.

			Ft.	In.
Shale, sandy				
Coal, estimated	2′	0″		
Slate	1	0		
Coal	0	2	3	2

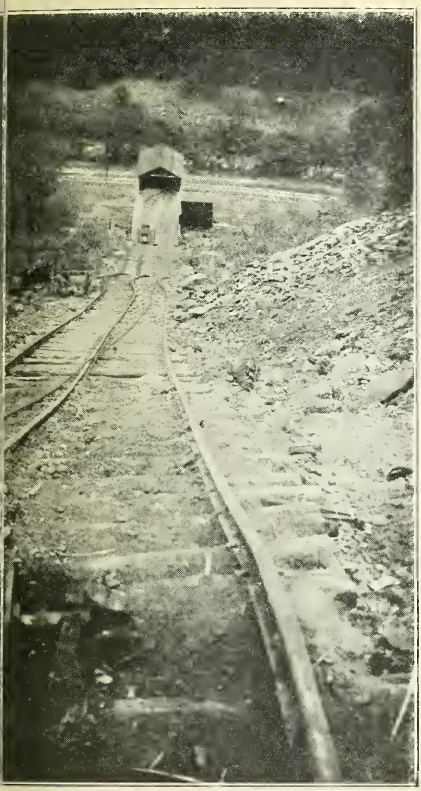


PLATE XXV (a).—Tipple and incline of Laurel Hill Mining Company, 0.7 mile below Arcola.

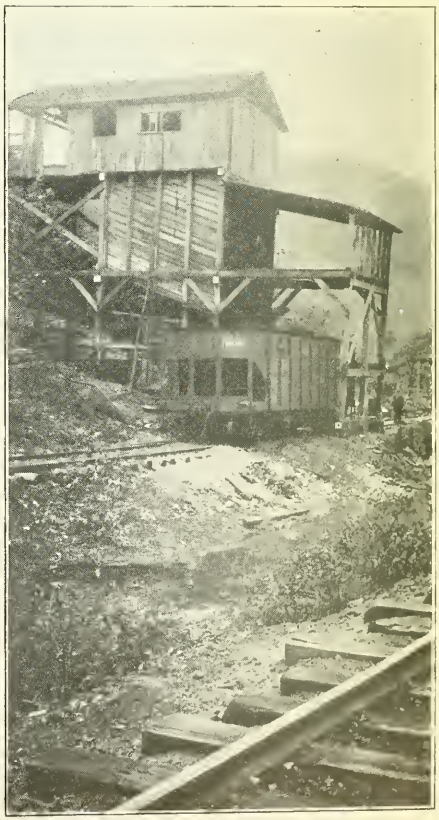


PLATE XXV (b).—Front view of same tipple.

	Ft.	In.
Fire clay shale	5	0
Sandstone, massive, to grade	25	0

The above exposure was visible in a perpendicular cut, thicknesses being estimated by eye.

Farm Mine No. 346 on Map II, located on Laurel Creek, 0.1 mile west of Marcus, at an elevation of 2090′ B., had fallen shut, its thickness not being learned.

The **Solomon Wain Farm Mine (No. 347 on Map II)**, located on Dry Branch of Laurel Creek, 0.3 mile northwest of Marcus, measured 2′ 2″ of clean, medium-soft coal, at an elevation of 2090′ B.

The **Solomon Wain Farm Mine (No. 348 on Map II)**, located on Dry Branch of Laurel Creek, 0.4 mile northwest of Marcus, measured 2′ 2″ of clean, soft coal, with an elevation of 2085′ B.

The **Lee Gadd Farm Mine (No. 349 on Map II)**, located on Denison Run of Laurel Creek, 0.8 mile southward from Marcus, measured 2′ 4″ of clean coal, with an elevation of 2210′ B.

C. Myers Farm Mine—No. 350 on Map II.

On Denison Run of Laurel Creek, 1.2 miles southward from Marcus; **Peerless Coal**; elevation, 2250′ B.

		Ft.	In.
Sandstone, massive			
Coal	0′ 6½″		
Slate, black	0 0½		
Coal, soft	1 10	2	5
Slate, pavement			

C. Myers Farm Mine—No. 351 on Map II.

On Denison Run of Laurel Creek, 1.3 miles southward from Marcus; **Peerless Coal**; elevation, 2245′ B.

		Ft.	In.
Sandstone, massive			
Coal	0′ 5½″		
Slate, black, bony	0 1½		
Coal, soft	2 0	2	7
Slate, pavement			

The **Webster County Poor Farm Mine (No. 352 on Map II)**, located on Denison Run of Laurel Creek, 1.7 miles southeast of Marcus, measured 1′ 10″ of clean, soft, columnar coal, with an elevation of 2275′ B.

The **Thomas J. Given Farm Mine (No. 353 on Map II)**, located on Denison Run of Laurel Creek, 2.3 miles northeast of Cowen, measured 2′ 3″ of clean, soft coal, with an elevation of 2325′ B.

The following mine supplies a considerable domestic fuel trade in Cowen and the surrounding neighborhood:

Watson Hollister Farm Mine—No. 354 on Map II.

On Denison Run of Laurel Creek, 2 miles northeast of Cowen; **Peerless Coal**; elevation, 2320′ B.

	Ft.	In.
1. Slate, dark		
2. **Coal**, soft, columnar	2	7
3. Slate, pavement		

A sample (No. 182R) was collected from No. 2 of section, the composition of which is published under **Mine No. 354** in the Survey Table of Coal Analyses at the end of this Chapter.

The **Charles Henderson Farm Mine (No. 355 on Map II)**, located on Denison Run of Laurel Creek, 2.5 miles northeast of Cowen, measured 2′ 3″ of soft, columnar coal, without partings, its elevation being 2300′ B.

On the waters of Birch River several openings have been made in the Peerless, the following having been noted:

Black Betsey Coal Company Prospect—No. 356 on Map II.

On the north branch of Skyles Creek, 1.4 miles northeast of Skyles; **Peerless Coal**; elevation, 1510′ B.

			Ft.	In.
Sandstone, massive			30	0
Shale, sandy			4	0
Coal, soft	1′	3″		
Slate, dark	0	1		
Coal	0	8	2	0
Concealed by debris				

Black Betsey Coal Company Farm Mine—No. 357 on Map II.

On Skyles Creek, 1.7 miles southeast of Skyles; **Peerless Coal**; elevation, 1520′ B.

			Ft.	In.
Shale, dark			5	0
Shale, ferriferous			0	6
Coal, slaty	0′	4″		
Coal, medium-soft	2	6	2	10
Slate, pavement				

A sample (No. J) once apparently taken from this mine by J. W. Paul, the analysis of which was furnished the Survey through the courtesy of George F. Duck, of Clearfield, Pa., shows the following composition:

	Per cent.
Moisture	0.81
Volatile Matter	35.91
Fixed Carbon	51.15
Ash	12.13
Total	100.00
Sulphur	4.70

Black Betsey Coal Company Farm Mine—No. 358 on Map II.

On Ming Run of Birch River, 0.5 mile northward from Boggs; **Peerless Coal**; elevation, 1610′ B.

			Ft.	In.
Shale, dark, sandy			10	0
Coal, slaty, laminated	0′	3″		
Coal, soft, with streaks of slate and splint	2	11	3	2
Slate, pavement				

A sample (No. F) once taken from this opening by J. W. Paul, the analysis of which was furnished the Survey by Mr. Duck, shows the following composition:

	Per cent.
Moisture	1.04
Volatile Matter	29.71
Fixed Carbon	46.00
Ash	23.25
Total	100.00
Sulphur	4.45

The C. B. Fowler Farm Mine (No. 359 on Map II), located on Barnet Run of Birch River, 0.6 mile southwest of Boggs, at an elevation of 1765′ B., had fallen shut, its thickness not being learned.

James Holmes Farm Mine—No. 360 on Map II.

On Barnet Run of Birch River, 1 mile southward from Boggs; Peerless Coal; elevation, 1775′ B.

		Ft.	In.
Shale, sandy			
Coal, laminated	0′ 6″		
Coal, soft	2 6	3	0
Slate, pavement			

A sample (No. G), apparently taken from this mine by J. W. Paul, the upper laminated member being rejected, shows the following composition, as reported by Mr. Duck:

	Per cent.
Moisture	2.34
Volatile Matter	34.14
Fixed Carbon	61.32
Ash	2.20
Total	100.00
Sulphur	0.73

A comparison of the analysis of coal from this opening with that of Mines Nos. 357 and 358, as published above, indicates quite clearly that much of the impurities of the latter two mines is due to the inclusion of the laminated coal at the top of the seam when sampling.

R. S. Bragg Farm Mine—No. 361 on Map II.

On Barnet Run of Birch River, 1.2 miles southward from Boggs; Peerless Coal; elevation, 1775′ B.

		Ft.	In.
Shale, dark		10	0
Coal, laminated	0′ 4″		
Coal, soft	2 10	3	2
Slate, pavement			

William Bragg Farm Mine—No. 362 on Map II.

On Barnet Run of Birch River, 1.3 miles southward from Boggs; **Peerless Coal**; elevation, 1775′ B.

			Ft.	In.
Shale, dark, sandy			7	0
Coal, laminated	0′	3″		
Coal, soft	2	9	3	0
Slate, pavement				

The **Felix Bragg Farm Mine** (No. 363 on Map II), located on Laurel Fork of Birch River, 0.8 mile northeast of Boggs, measured 2′ 0″ of clean coal, with an elevation of 1740′ B.

The **Dorsey Smith Farm Mine** (No. 364 on Map II), located on Laurel Fork of Birch River, 1.5 miles northeast of Boggs, had fallen shut, the thickness of the coal being reported as 2′ 8″, with an elevation of 1745′ B.

In the Gauley River drainage several openings have been made in the Peerless Coal, the following having been noted:

Coal Exposure—No. 365 on Map II.

Along the public road on Strouds Creek, 0.5 mile northwest of Strouds; **Peerless Coal**; elevation, 2140′ B.

			Ft.	In.
Shale, sandy			4	0
Coal, soft	1′	8″		
Fire clay and sandy shale	5	0		
Coal	0	2	6	10
Fire clay shale				

The **Thomas Harris Farm Mine** (No. 366 on Map II), located on a branch of Coon Creek, 1.4 miles northward from Camden-on-Gauley, measured 1′ 4″ of coal, at an elevation of 2360′ B.

The **William McCumber Prospect** (No. 367 on Map II), located on Coon Creek, 1.8 miles northward from Camden-on-Gauley, at an elevation of 2295′ B., had fallen shut, the seam being reported thin at that point.

Catherine Woods Farm Mine—No. 368 on Map II.

On a branch of Big Ditch Run of Gauley River, 1.4 miles southwest of Cowen; Peerless Coal; elevation, 2320′ B.

			Ft.	In.
Shale, dark			5	0
Coal, soft	1′	2″		
Coal, bony	0	4		
Coal, soft	0	6	2	0
Slate, pavement				

The **Smoot Lumber Company Prospect (No. 369 on Map II)**, located on a branch of Big Ditch Run of Gauley, 1 mile southeast of Cowen, at an elevation of 2340′ B., had fallen shut, its thickness being reported as 1′ 8″.

Coal Prospect No. 370 on Map II, located on Big Ditch Run of Gauley, 0.7 mile southward from Cowen at an elevation of 2325′ B., had fallen shut, no report on its thickness having been obtained.

The **Smoot Lumber Company Prospect (No. 371 on Map II)**, located on Big Ditch Run of Gauley, 0.6 mile southeast of Cowen, at an elevation of 2345′ B., measured 1′ 4″ of clean, soft coal.

At the **Joseph Anderson Exposure (No. 372 on Map II)**, located on Big Ditch Run of Gauley, 0.2 mile south of Cowen, at an elevation of 2285′ B., the coal is visible in a spring, its thickness being reported by the owner as 1′ 6″.

The **William G. Woods Farm Mine (No. 373 on Map II)**, located on Big Ditch Run of Gauley, at the west edge of Cowen, measured 1′ 7″ of clean coal, its elevation being 2265′ B.

The **Thomas J. Given Farm Mine (No. 374 on Map II)**, located on the head of a short branch of Gauley, 0.6 mile northwest of Upper Glade, at an elevation of 2330′ B., had fallen shut, no report as to the thickness of the coal having been obtained.

Quantity of Campbell Creek (Peerless Bench) Coal Available.

The following table, compiled by Miss Buchanan from a planimetric measurement of the outcrop on Map II, shows

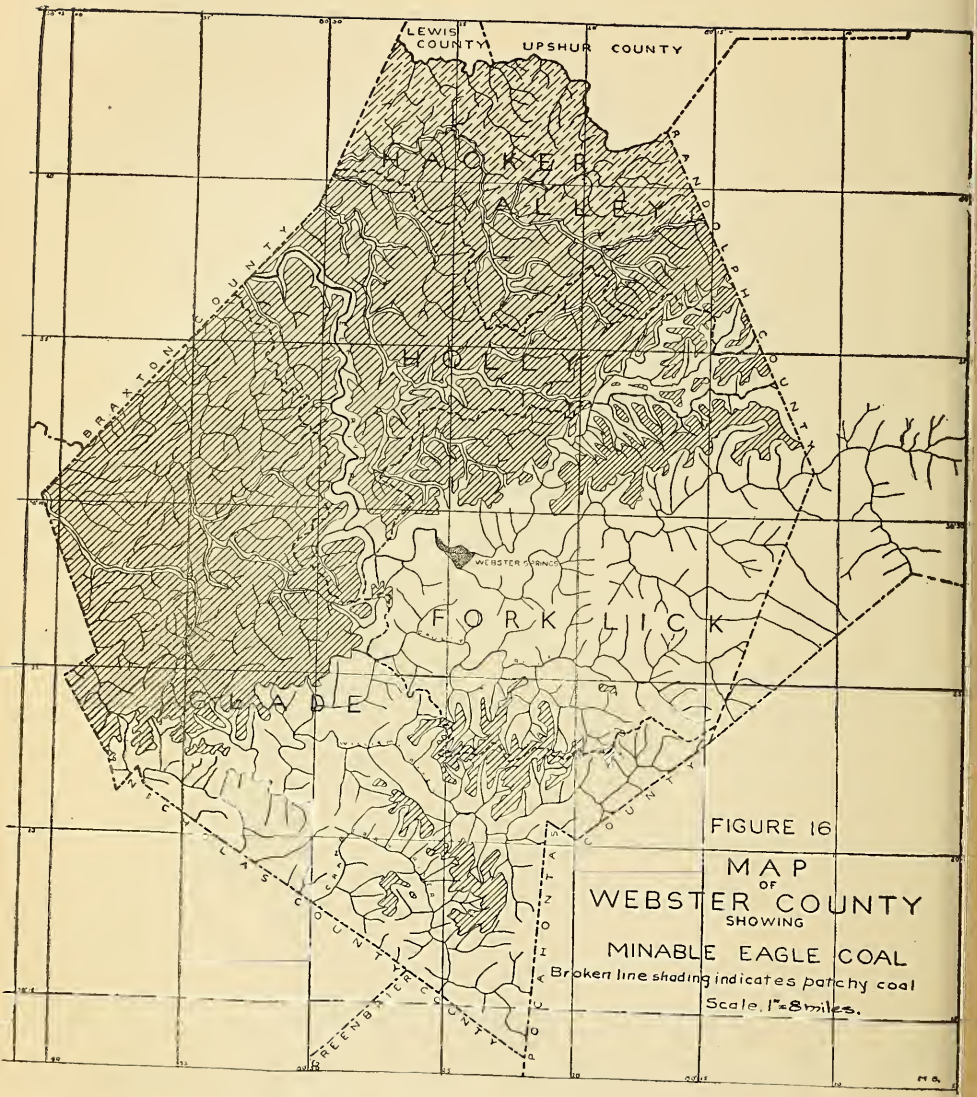
the probable amount of Peerless Coal by districts in the county:

Probable Amount of Campbell Creek (Peerless) Coal.

Webster County by Districts	Thickness of Coal Assumed. Fee	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	2	62.65	40,096	3,493,163,520	139,726,541
Holly	2	61.80	40,552	3,445,770,240	137,830,810
Fork Lick	2	16.40	10,496	914,411,520	36,576,461
Glade	2	94.30	60,352	5,257,866,240	210,314,649
Totals		235.15	150,496	13,111,211,520	524,448,461

EAGLE COAL.

The Eagle Coal, previously discussed in Chapter VI, page 173, is the most widely persistent seam of coal in the Kanawha Group in Webster, being 2 to 4 feet in thickness and covering more than half of the northwestern end of the county, where it has been prospected and mined extensively for local domestic fuel and has also been mined commercially on a small scale. Its outcrop is shown on Map II where its horizon has been used as the basis for the green structure contours covering the northwestern portion of the county, and its areal distribution is exhibited on Figure 16.



Eagle Coal, Hacker Valley District.

In Hacker Valley District the Eagle Coal has been prospected and mined for local fuel at numerous points in the Holly River drainage, the following openings having been noted:

John T. McGraw Farm Mine—No. 387 on Map II.

On south side of Left Fork of Holly River, 1.1 miles eastward from Marpleton; **Eagle Coal**; elevation, 1085′ B.

	Ft.	In.
1. Shale, sandy	10	0
2. **Coal**, medium-soft	2	6
3. Slate, pavement		

A sample (No. 217R) was collected from this opening, the composition of which is published under **Mine No. 387** in the Survey Table of Coal Analyses at the end of this Chapter.

The **John T. McGraw Prospect (No. 388 on Map II)**, located on the north side of Left Fork of Holly River, 1.1 miles east of Marpleton, at an elevation of 1085′ B., measured 2′ 5″ of clean, semi-splint coal.

The **John T. McGraw Prospect (No. 389 on Map II)**, located on a short branch of Left Fork of Holly, 1.4 miles southwest of Poling, measured 2′ 0″ of hard, splinty coal, at an elevation of 1155′ B.

Coal Exposure—No. 390 on Map II.

On Left Fork of Holly River at the mouth of Long Run, 0.6 mile southwest of Poling; **Eagle Coal**; elevation, 1155′ B.

			Ft.	In.
Sandstone, massive			5	0
Coal, semi-splint	1′	0″		
Slate, dark	0	8		
Coal	0	2	1	10
Shale and concealed to Holly River				

At the **P. J. Cothren Exposure (No. 391 on Map II)**, located on Left Fork of Holly, 0.4 mile eastward from Poling, the coal measured 1′ 8″ thick in a railroad cut, its elevation being 1250′ B.

Robert Berry Farm Mine—No. 392 on Map II.

On Left Fork of Holly River, 0.7 mile eastward from Poling; **Eagle Coal**; elevation, 1240′ B.

	Ft.	In.
Sandstone, massive, cliff, **Eagle Sandstone**	40	0
Coal	1	10
Fire clay shale and concealed to river	15	0

The **May Duke Farm Mine (No. 393 on Map II)**, located on Left Fork of Holly, 0.6 mile northwest of Wheeler, measured 2′ 7″ thick, with a parting, as exhibited in the section for Wheeler, page 74, its elevation being 1315′ L.

A. L. Harris Prospect—No. 394 on Map II.

On Left Fork of Holly River, 0.9 mile northward from Pugh; **Eagle Coal**; elevation, 1415′ B.

			Ft.	In.
Sandstone, massive				
Shale, limy and ferriferous			1	6
Coal, medium-hard	0′	9″		
Coal, splint	0	2		
Coal, medium-hard	1	5	2	4
Slate, pavement				

The **A. W. Anderson Prospect (No. 395 on Map II)**, located just north of Pugh, at an elevation of 1450′ B., had fallen shut, its thickness not being learned, and the **A. W. Anderson Prospect (No. 396 on Map II)**, located on Left Fork of Holly, just south of Pugh, at an elevation of 1460′ B., had also fallen shut, no report of its thickness having been obtained.

A. W. Anderson Farm Mine—No. 397 on Map II.

On Left Fork of Holly River, 0.6 mile south of Pugh; **Eagle Coal**; elevation, 1490′ B.

			Ft.	In.
Sandstone, shaly			5	0
Slate, dark			0	4
Coal, medium-hard	2′	5″		
Slate, cannel	0	6		
Coal, medium-hard	1	2	4	1
Slate, pavement				

At the following opening the coal has been mined for use at the plant of the Mayton Lumber Company, as well as for its logging locomotives and for the domestic use of its employees:

Mayton Lumber Company Mine—No. 398 on Map II.

On Hodam Creek, near its mouth, and 1.1 miles southwest of Hacker Valley; **Eagle Coal**; Butts, N. 83° W.; elevation, 1495′ B.

			Ft.	In.
1. Slate, black				
2. **Coal**, medium-hard	1′	0″		
3. **Coal**, hard, bony splint	0	3		
4. **Coal**, medium-hard	2	0	3	3
5. Slate, pavement				

A sample (No. 168R) was collected from Nos. 2, 3, and 4 of section, the composition of which is published under **Mine No. 398** in the Survey Table of Coal Analyses at the end of this Chapter.

Another sample (No. 21) was collected by D. D. Teets, Jr., the composition of which is published under **Mine No. 398** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Coal Prospect—No. 399 on Map II.

On Hodam Creek, 0.9 mile southwest of Hacker Valley; **Eagle Coal**; elevation, 1510′ B.

			Ft.	In.
Shale, sandy				
Coal, medium-hard	1′	10″		
Coal, splinty	0	6		
Coal, medium-hard	2	0	4	4
Concealed by water and mud				

Mayton Lumber Company Prospect—No. 400 on Map II.

On a branch of Hodam Creek, 1 mile northwest of Hodam village; **Eagle Coal**; elevation, 1760′ B.

			Ft.	In.
Slate, dark				
Sandstone, shaly			1	0
Coal, medium-hard	2′	2″		
Coal, bony	0	4	2	6
Slate, pavement, and concealed			2	0
Sandstone, massive				

The **H. Clay Mace Prospect (No. 401 on Map II)**, located on Hodam Creek, 0.3 mile northwest of Hodam village, at an

elevation of 1860′ B., had fallen shut, the coal being reported 3 feet thick by Ballard Carpenter.

The **Everett Hamrick Prospect (No. 402 on Map II)**, located on Hodam Creek, 0.2 mile west of Hodam village, at an elevation of 1870′ B., had fallen shut, its thickness, as reported by Mr. Carpenter, being 1′ 6″.

James Ware Farm Mine—No. 403 on Map II.

On Big Lick Fork of Hodam Creek, 0.9 mile northeast of Hodam village; **Eagle Coal**; elevation, 1875′ B.

			Ft.	In.
Slate, dark				
Coal, soft	1′	6″		
Slate, bony	0	4		
Coal, medium-hard	1	4	3	2
Slate, pavement				

J. G. Dever Farm Mine—No. 404 on Map II.

On Big Lick Fork of Hodam Creek, 1 mile northeast of Hodam village; **Eagle Coal**; elevation, 1890′ B.

			Ft.	In.
Slate, dark				
Coal	1′	5″		
Slate, bony	0	4		
Coal	1	4	3	1
Slate, pavement				

William Collins Farm Mine—No. 405 on Map II.

On Hodam Creek, 0.3 mile southwest of Hodam village; **Eagle Coal**; elevation, 1875′ B.

			Ft.	In.
Sandstone, massive				
Coal, soft	1	4″		
Slate, bony	0	8		
Coal, reported	1	3	3	3

Coal Prospect No. 406 on Map II, located on Left Fork of Holly River, 0.9 mile southwest of Hacker Valley, at an elevation of 1500′ B., had fallen shut and its thickness was not learned.

The **Floyd Mace Farm Mine (No. 407 on Map II)**, located

on Left Fork of Holly, 0.6 mile southwest of Hacker Valley, measured 4′ 0″ of clean, medium-hard coal, its elevation being 1485′ B.

Coal Prospect No. 408 on Map II, located on Left Fork of Holly, 0.4 mile westward from Hacker Valley, at an elevation of 1500′ B., had fallen shut, no report as to the thickness of the coal having been obtained.

Charles Kee Farm Mine—No. 409 on Map II.

On Left Fork of Holly at the northwest edge of Hacker Valley; **Eagle Coal;** elevation, 1510′ B.

	Ft.	In.
Sandstone, massive, **Eagle**	25	0
Coal, medium-hard	1	6
Concealed	5	0
Sandstone, massive, to creek	15	0

The **Henry Cowger Prospect (No. 410 on Map II),** located on Left Fork of Holly, opposite the mouth of Johns Run and 2.5 miles southeast of Hacker Valley, measured 1′ 4″, its elevation being 1675′ B.

Butcher Anderson Farm Mine—No. 411 on Map II.

On Fall Run of Left Fork of Holly, 1 mile southwest of Penbro; **Eagle Coal;** elevation, 2125′ B.

		Ft.	In.
Sandstone, massive			
Coal, hard	0′ 8″		
Slate, black	0 7		
Coal, medium-hard	1 10	3	1
Slate, pavement, and concealed to run		4	0

Hazel Cogar Farm Mine—No. 412 on Map II.

On Fall Run of Left Fork of Holly, 0.9 mile southeast of Penbro; **Eagle Coal;** elevation, 2370′ B.

		Ft.	In.
Sandstone, massive		15	0
Coal, bony	0′ 4″		
Coal, semi-splint	1 2		
Coal, bony	0 3		
Coal, soft	0 6		
Coal, semi-splint	0 10	3	1
Slate, black		0	6
Sandstone, massive and sandy shale		45	0
Limestone, siliceous, **Eagle?**		0	4

John Anderson Farm Mine—No. 413 on Map II.

On Left Fork of Holly River, near the mouth of Fall Run and 2.4 miles southwest of Penbro; **Eagle Coal**; elevation, 1810′ B.

			Ft.	In.
Shale, dark, sandy				
Coal, hard	0′	6″		
Coal, medium-soft	3	3	3	9
Slate, pavement, and concealed			5	0
Sandstone, makes falls in river				

The **Mayton Lumber Company Prospect (No. 414 on Map II)**, located on Straight Fork of Left Fork of Holly, 2.1 miles southward from Penbro, at an elevation of 2450′ B., had fallen shut, its thickness not being learned.

Eagle Coal, Holly District.

In Holly District the Eagle Coal has been prospected mainly on Oldlick Creek and Right Fork of Holly, as well as in certain portions of the Elk River drainage basin where the district laps across it.

On Oldlick Creek, which is tributary to Left Fork of Holly at Marpleton, the following openings were noted:

John Christenson Farm Mine—No. 415 on Map II.

On Oldlick Creek, 1.1 miles northeast of Fishers Crossing; **Eagle Coal**; elevation, 1200′ B.

	Ft.	In.
Sandstone, massive, **Eagle**, visible	8	0
Shale, dark	2	0
Coal, hard	2	9
Slate, pavement		

At the following opening the coal is being mined commercially on a small scale:

Oldlick Run Coal and Coke Company Mine—No. 416 on Map II.

On Oldlick Creek, 0.4 mile below Negro Camp Run and 1.8 miles northeast of Salisbury; **Eagle Coal**; elevation, 1380′ B.

			Ft.	In.
1. Slate, black				
2. **Coal**, soft	1′	6″		
3. **Coal**, cannel splint	0	5		
4. **Coal**, soft	0	10		
5. **Coal**, bony	0	4		
6. **Coal**, medium-soft	1	0	4	1
7. Slate, pavement				

A sample (No. 233R) was collected from Nos. 2, 3, 4, and 6 of section, the composition of which is published under **Mine No. 416** in the Survey Table of Coal Analyses at the end of this Chapter.

A slightly different section, obtained in another portion of the same mine, shows the following:

			Ft.	In.
1. Slate, black				
2. **Coal**, splinty	2′	10″		
3. Cannel bone	0	6		
4. **Coal**, splinty	1	0	4	4
5. Slate, pavement				

A sample (No. 170R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 416** in the Survey Table of Coal Analyses at the end of this Chapter. A comparison of the two analyses would indicate that the high amount of sulphur found in Sample No. 170R comes largely from No. 5 of the first section published, and that the rejection of this member from shipment would result in the production of a fine grade of coal.

The **John E. Roller Prospect (No. 417 on Map II)**, located on Oldlick Creek, 0.2 mile below Cougar Fork and 2.2 miles southeast of Salisbury, measured 2′ 9″ of splinty coal, its elevation being 1475′ B.

On Right Fork of Holly River the Eagle has been prospected in more detail than in any other portion of the county, the following openings having been noted:

E. G. Robinson Prospect—No. 418 on Map II.

On Hannah Run of Right Fork of Holly River, 0.9 mile westward from Fishers Crossing; Eagle Coal; elevation, 1065′ B.

			Ft.	In.
Sandstone, massive, cliff, Eagle			50	0
Shale, dark, sandy, Newlon			20	0
Coal, blocky	0′	5½″		
Slate, gray	0	1½		
Coal, medium-hard	1	3	1	10
Slate, pavement				

The above measurement was made at the outcrop, the prospect having partly fallen shut, the thickness of coal at the face being reported as 2′ 0″.

The E. G. Robinson Prospect (No. 419 on Map II), located on Hannah Run of Right Fork of Holly, 0.8 mile westward from Fishers Crossing, measured 1′ 6″, its elevation being 1065′ B.

The A. W. Morrison Prospect (No. 420 on Map II), located on Narrows Run of Right Fork of Holly, 1.2 miles southwest of Salisbury, at an elevation of 1265′ B., had fallen partly shut, there being 1′ 8″ of medium-soft coal visible, the full thickness being reported as 2′ 6″.

A. W. Morrison Prospect—No. 421 on Map II.

On Narrows Run of Right Fork of Holly River, 1.2 miles southwest of Salisbury; Eagle Coal; elevation, 1260′ B.

			Ft.	In.
Sandstone, massive				
Coal, medium-soft	0′	10″		
Coal, cannelly	0	5		
Coal, medium-soft	1	4	2	7
Slate, pavement, to run				

Benjamin Cogar Farm Mine—No. 422 on Map II.

On Right Fork of Holly River, 0.3 mile southward from Fishers Crossing; Eagle Coal; elevation, 1265′ B.

			Ft.	In.
Sandstone, massive				
Coal, hard	0′	9″		
Coal, cannel bone	0	1		
Coal, hard, splinty	1	5	2	3
Slate, pavement				

PLATE XXVI (a).—Mine entrance and pony haulage at Laurel Hill Mining Company plant (No. 331 on Map II); Peerless Coal.

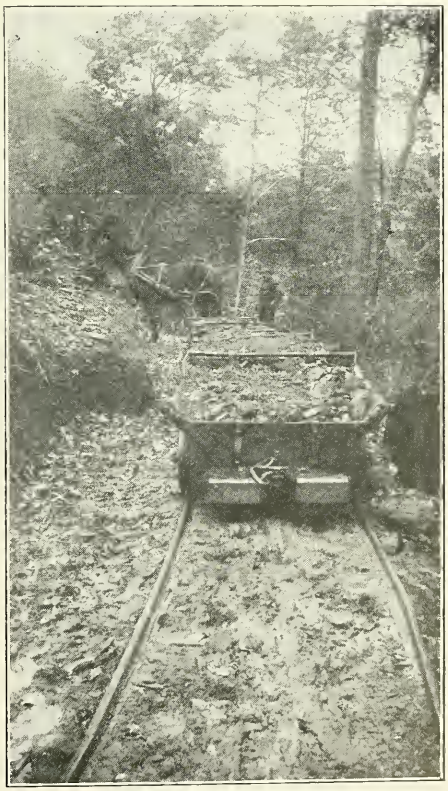


PLATE XXVI (b).—Peerless Coal on mine cars at same mine.

P. M. McElwain Farm Mine—No. 423 on Map II.

On a short branch of Right Fork of Holly River, 0.3 mile southeast of Fishers Crossing; **Eagle Coal**; elevation, 1240′ B.

			Ft.	In.
Sandstone, massive				
Slate, black			5	0
Coal, medium-hard	0′	9″		
Coal, cannelly	0	1		
Coal, medium-hard	1	2	2	0
Slate, pavement				

The Andrew Salisbury Farm Mine (No. 424 on Map II), located on Right Fork of Holly River, just northeast of Salisbury Station, at an elevation of 1285′ B., had fallen shut, the thickness of the coal being reported as 4′ 0″.

William Clifton Farm Mine—No. 425 on Map II.

On Bear Run of Right Fork of Holly River, 0.7 mile southeast of Salisbury; **Eagle Coal**; elevation, 1325′ B.

			Ft.	In.
Sandstone, massive				
Shale, dark, sandy			6	0
Coal, soft	0′	3″		
Coal, medium-hard	2	1		
Cannel bone	0	4		
Coal, medium-hard	1	2	3	10
Slate, pavement				

The John Shrader Farm Mine (No. 426 on Map II), located on Beaver Run of Right Fork of Holly, 0.5 mile southeast of Salisbury, at an elevation of 1345′ B., measured 2′ 3″ of clean coal.

James Shrader Farm Mine—No. 427 on Map II.

On Beaver Run of Right Fork of Holly River, 0.6 mile southeast of Salisbury; **Eagle Coal**; elevation, 1340′ B.

			Ft.	In.
Shale, sandy, dark, **Newlon**			5	0
Coal, medium-hard	2′	4″		
Cannel bone	0	4		
Coal, medium-hard	1	3	3	11
Slate, pavement				

Floyd Siffles Farm Mine—No. 428 on Map II.

On Beaver Run of Right Fork of Holly River, 0.8 mile southeast of Salisbury; Eagle Coal; elevation, 1350′ B.

			Ft.	In.
Shale, sandy, dark, Newlon			8	0
Coal, medium-hard	2′	3″		
Coal, bony	0	3		
Coal, medium-hard	1	0	3	6
Slate, pavement				

A sample (No. 40) was collected from this opening by D. D. Teets, Jr., the composition of which is published under Mine No. 428 in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The **Shrader Farm Mine (No. 429 on Map II)**, located on Right Fork of Holly, 0.6 mile south of Salisbury, measured 3′ 9″ of clean, medium-hard coal, its elevation being 1340′ B.

The **Lee Hall Prospect (No. 430 on Map II)**, located on Right Fork of Holly River, 0.8 mile southwest of Salisbury, at an elevation of 1340′ B., measured 4′ 4″, according to F. E. Bittenbender of the West Virginia Midland Collieries Company, which owns the coal under a large number of farms in this vicinity.

The **Ed. Cochran Prospect (No. 431 on Map II)**, located on Right Fork of Holly River, 0.9 mile south of Salisbury, at an elevation of 1360′ B., had partly fallen shut, its thickness being apparently 3 to 4 feet.

The **James Carpenter Farm Mine (No. 432 on Map II)**, located between the forks of Weese Run of Right Fork of Holly, 1.4 miles southward from Salisbury, was partly filled with water, its elevation being 1350′ B., and its apparent thickness 3 to 4 feet.

James Lough Farm Mine—No. 433 on Map II.

On Right Fork of Holly River, 1.3 miles southwest of Salisbury; Eagle Coal; elevation, 1290′ B.

	Ft.	In.
Shale, dark, sandy, Newlon	8	0

Coal, medium-hard	3′	0″		
Slate, black, bony	0	5		
Coal, medium-hard	1	5	4	10
Slate, pavement				

A sample (No. 41) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 433** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Farm Mine No. 434 on Map II, located on Right Fork of Holly, 1 mile northward from Big Run Station, at an elevation of 1310′ B., had fallen shut, its thickness not being learned.

The **Viola Lough Farm Mine (No. 435 on Map II),** located on Right Fork of Holly, 0.4 mile southeast of Big Run Station, at an elevation of 1410′ B., had fallen shut, no report having been obtained on the thickness of the coal.

The **Albert Riffle Farm Mine (No. 436 on Map II),** located on a branch of Lower Big Run, 1.1 miles northeast of Big Run Station, at an elevation of 1400′ B., showed a variable thickness of 2 to 3 feet.

The **Martin Miller Farm Mine (No. 437 on Map II),** located on Right Fork of Holly, 0.4 mile southeast of Big Run Station, measured 2′ 5″ of clean, medium-hard coal, at an elevation of 1420′ B.

The **J. W. Cool Farm Mine (No. 438 on Map II),** located on Right Fork of Holly, 1.2 miles northwest of Diana, at an elevation of 1445′ B., was partly filled with water, its apparent thickness being about 3 feet.

The **H. P. Cutlip Heirs Farm Mine (No. 439 on Map II),** located on Right Fork of Holly, 0.6 mile northward from Diana, at an elevation of 1460′ B., had fallen shut, no report having been obtained as to the thickness of the coal.

William Fisher Farm Mine—No. 440 on Map II.

On Grassy Creek of Right Fork of Holly River, 1.4 miles southward from Diana; **Eagle Coal**; elevation, 1640′ B.

			Ft.	In.
1. Slate, black				
2. **Coal**, soft	1′	6″		
3. Cannel bone	0	8		
4. **Coal**, medium-soft	0	7		
5. **Coal**, bony	0	1½		
6. **Coal**, medium-soft	1	0	3	10½
7. Slate, pavement				

A sample (No. 239R) was collected from Nos. 2, 4, 5, and 6 of section, the composition of which is published under **Mine No. 440** in the Survey Table of Coal Analyses at the end of this Chapter.

Jennie Rix Farm Mine—No. 441 on Map II.

On Grassy Creek, just north of W. Va. Midland Water Station and 1.6 miles southwest of Diana; **Eagle Coal**; elevation, 1555′ B.

			Ft.	In.
Shale, dark, sandy				
Coal, medium-soft	1′	3″		
Cannel bone	1	4		
Coal, medium-soft	1	2	3	9
Slate, pavement				

John W. Arthur Farm Mine—No. 442 on Map II.

On Grassy Creek, 0.6 mile southeast of Summit Station; **Eagle Coal**; elevation, 1775′ B.

	Ft.	In.
Sandstone, massive, cliff, **Eagle**	30	0
Coal, medium-soft	2	3
Fire clay shale, 1′ to	3	0
Sandstone, shaly		

John W. Arthur Farm Mine—No. 443 on Map II.

On Grassy Creek, 0.7 mile southeast of Summit Station; **Eagle Coal**; elevation, 1790′ B.

	Ft.	In.
Sandstone, massive, cliff, **Eagle**	20	0
Slate, dark, 0″ to	1	0
Coal, medium-soft	2	3
Fire clay, shale, and concealed to creek	25	0

Harmon Ware Farm Mine—No. 444 on Map II.

On Wrack Timber Run of Right Fork of Holly River, 1.1 miles eastward from Diana; **Eagle Coal**; elevation, 1660′ B.

			Ft.	In.
Slate, black				
Coal, hard, bony	0′	5″		
Coal, medium-soft	1	1		
Coal, hard, bony splint	0	10		
Slate, black, bony	0	5		
Coal, medium-soft	2	0	4	9
Slate, pavement				

The **James Clifton Farm Mine** (No. 445 on Map II), located on Right Fork of Holly, 1.1 miles westward from Jumbo, measured 3′ 0″ of clean, medium-hard coal, with an elevation of 1735′ B.

Coal Prospect No. 446 on Map II, located along the highway north of Desert Fork of Holly, 0.7 mile northward from Jumbo, at an elevation of 1904′ L., had fallen shut, its thickness not being learned.

The **G. W. Curtin Heirs Prospect** (No. 447 on Map II), located on Desert Fork of Right Fork of Holly, 1.8 miles northeast of Jumbo, at an elevation of 1855′ B., had fallen shut, no report having been obtained as to the thickness of the coal.

The **G. W. Curtin Heirs Prospect** (No. 448 on Map II), located on Desert Fork of Right Fork of Holly, 1.9 miles northeast of Jumbo, at an elevation of 1870′ B., showed 1′ 0″ of coal, there being some question as to whether the full seam was exposed.

Hall Farm Mine—No. 449 on Map II.

On Right Fork of Holly River, 1.4 miles southeast of Jumbo; **Eagle Coal**; elevation, 1770′ B.

	Ft.	In.
Slate, black, with **Lingula** fossils, **Newlon**	5	0
Coal, soft, columnar, partly concealed by water, 2′ 0″ to	3	0

Farm Mine No. 450 on Map II, located on Right Fork of Holly, 1.7 miles southeast of Jumbo, at an elevation of 1805′ B., measured 2′ 4″ of clean, medium-soft coal.

The **M. P. Brooks Prospect (No. 451 on Map II)**, located on Right Fork of Holly, opposite the mouth of Laurel Fork and 2.2 miles southeast of Jumbo, at an elevation of 1870′ B., had fallen shut, the coal being reported 1 foot thick by the owner.

Coal. Exposure No. 452 on Map II, located on Laurel Fork of Right Fork of Holly, 2.4 miles southeast of Jumbo, measured 1′ 0″, its elevation being 1895′ B.

On Elk River and its tributaries a few prospects have been made in the Eagle Coal in Holly District, the following having been noted:

Davis-Eakin Lumber Company Farm Mine—No. 453 on Map II.

On Houston Run of Elk River, 1.2 miles southeast of Centralia; **Eagle Coal**; elevation, 1190′ B.

			Ft.	In.
Sandstone, massive, **Eagle**				
Coal, slaty	0′	4″		
Coal, soft	2	0		
Coal, bony	0	4		
Coal, medium-soft	1	0	3	8
Slate, pavement				

A sample (No. 37) was collected from this opening by D. D. Teets, Jr., the composition of which is published under Mine No. 453 in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Martin Brooks Farm Mine—No. 454 on Map II.

On the Houston Run of Elk River, 1.2 miles southeast of Centralia; **Eagle Coal**; elevation, 1270′ B.

			Ft.	In.
Sandstone, massive				
Shale, sandy, dark, ferriferous, **Newlon**			5	0
Coal, soft	1′	10″		
Coal, bony	1	4	3	2
Slate, pavement				

Dr. J. M. Brockerhoff Prospect—No. 455 on Map II.

On Houston Run of Elk River, 2.8 miles southeast of Centralia; Eagle Coal; elevation, 1365′ B.

			Ft.	In.
Sandstone, massive				
Shale, dark, Newlon			5	0
Coal, slaty	0′	3″		
Coal, medium-hard	1	10		
Coal, bony	1	1	3	2
Slate, pavement and concealed to run				

Davis-Eakin Lumber Company Prospect—No. 456 on Map II.

On Elk River, 2.3 miles eastward from Centralia; Eagle Coal; elevation, 1180′ B.

	Ft.	In.
Sandstone, massive, Eagle	20	0
Coal, soft	3	6
Slate, pavement		

The above section was measured at the outcrop of the coal which had all weathered out soft. A sample (No. 32) was collected from this opening by D. D. Teets, Jr., the composition of which is published under Mine No. 456 in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

William Clutter Farm Mine—No. 457 on Map II.

On Elk River, 0.8 mile northwest of Big Run Station; Eagle Coal; elevation, 1350′ B.

			Ft.	In.
Sandstone, massive			5	0
Coal, soft	2′	1″		
Slate, bony cannel	0	8		
Coal	0	7	3	4
Concealed by mud				

Samuel Thomas Farm Mine—No. 458 on Map II.

On Little Sugar Creek, 3.8 miles northeast of Skelt; Eagle Coal; elevation, 2820′ B.

			Ft.	In.
Slate, dark				
Coal, medium-hard	2′	3″		
Coal, bony	0	3	2	6
Slate, pavement				

Eagle Coal, Fork Lick District.

In Fork Lick District the Eagle Coal has been prospected principally on the waters of Grassy Creek of Right Fork of Holly River, the following openings having been noted:

The **Thomas Bender Farm Mine (No. 459 on Map II),** located on Little Grassy Creek, 1 mile above its mouth and 1.8 miles southward from Orndoff, at an elevation of 2207′ B., had fallen shut, its thickness being reported as 2′ 6″.

The **Enos Wine Farm Mine (No. 460 on Map II),** located on main Grassy Creek, 1.6 miles southwest of Orndoff, measured 2′ 3″ of clean, soft coal, coming 5 feet above creek level and having an elevation of 1840′ B.

Coal Prospect No. 461 on Map II, located on Grassy Creek, at the mouth of Big Run, 0.5 mile southwest of Orndoff, measured 1 foot in thickness, its elevation being 1930′ B.

O. F. Mace Farm Mine—No. 462 on Map II.

On Big Run of Grassy Creek, 0.4 mile westward from Orndoff; **Eagle Coal**; elevation, 1920′ B.

			Ft.	In.
Sandstone, massive, great cliff, **Eagle**			30	0
Slate, black			3	0
Coal, slaty	0′	6″		
Coal, good, medium-hard	1	6	2	0
Slate, pavement				

The **W. A. Arthur Prospect (No. 463 on Map II),** located on Warner Run of Grassy Creek, just east of Orndoff, at an elevation of 1975′ B., had fallen shut, its thickness being reported as 2′ 0″ of clean coal.

Coal Exposure No. 464 on Map II, located on Grassy Creek, 1 mile eastward from Orndoff, measured 0′ 6,″ at an elevation 1940′ B.

The four following openings were noted on Point Mountain, between Back Fork of Elk and main Elk River:

The **Lee A. Hamrick Prospect (No. 464A on Map II),** located on the north side of Point Mountain, 1.2 miles northeast of Waneta, at an elevation of 3400′ B., measured 1′ 11″ of clean coal.

The **Hale and Kinney Prospect (No. 464B on Map II)**, located on the north side of Point Mountain, 1.9 miles northeast of Waneta, at an elevation of 3455′ B., measured 2′ 0″ of clean coal.

The **Lee A. Hamrick Prospect (No. 464C on Map II)**, located on a spur of Point Mountain, 1.6 miles eastward from Waneta, at an elevation of 3535′ B., had fallen shut, but was reported to have measured 1′ 8″.

The **Lee A. Hamrick Prospect (No. 464D on Map II)**, located on the same spur of Point Mountain, 1 mile southeast of Waneta, at an elevation of 3635′ B., measured 1′ 8″ of clean coal, as recorded in the section for Waneta, page 100.

In that portion of Fork Lick District south of Elk River where the Eagle horizon is high in the tops of the mountains, what appears to represent it was observed at the **Pardee-Curtin Lumber Company Prospect (Adam Baughman Opening) No. 465 on Map II**, located at the head of a branch of Leatherwood Creek on the Gauley divide, 0.2 mile northwest of Cold Knob and 1.8 miles southward from Bergoo, there being 1′ 3″ of soft coal, at an elevation of 3530′ B.

Eagle Coal, Glade District.

In Glade District the Eagle Coal has been prospected and mined for local domestic fuel principally on the waters of Laurel Creek of Elk and on the head of Birch River as well as on certain tributaries of the Gauley. On Laurel Creek the following openings were noted:

William McWhorter Prospect—No. 466 on Map II.

On Camp Creek of Laurel Creek, 1.2 miles south of Centralia; **Eagle Coal**; elevation, 1145′ B.

		Ft.	In.
Sandstone, massive			
Shale, sandy, with iron ore, **Newlon**		5	0
Coal, slaty	0′ 3″		
Coal, medium-soft	1 10		
Coal, bony	1 6	3	7
Slate, pavement			

A sample (No. 38) was collected from this opening by

D. D. Teets, Jr., the composition of which is published under **Mine No. 466** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Coal Prospect No. 467 on Map II, located on Laurel Creek, 0.8 mile northward from Wainville, at an elevation of 1585′ B., had fallen shut, no report as to its thickness having been obtained.

Wainville Coal and Coke Company Farm Mine—No. 468 on Map II.

On Laurel Creek, 0.3 mile westward from Wainville; **Eagle Coal;** elevation, 1660′ B.

			Ft.	In.
Slate, dark				
Coal, soft	1′	5″		
Slate, dark	0	1		
Coal	0	2½		
Slate, dark	0	1½		
Coal, hard	1	0	2	10
Slate, pavement				

Coal Prospect No. 469 on Map II, located on Laurel Creek, 0.2 mile north of Wainville, at an elevation of 1635′ B., had fallen shut, the thickness of the coal not being learned.

The **Stalnaker and Hines Prospect (No. 470 on Map II),** located on Amos Run of Laurel Creek, 3.4 miles northeast of Wainville, at an elevation of 1830′ B., had fallen shut, its thickness not being learned.

The **Stalnaker and Hines Prospect (No. 471 on Map II),** located on Amos Run of Laurel Creek, 3.5 miles northeast of Wainville, measured 1′ 10″ of clean coal, at an elevation of 1820′ B.

The **B. F. Dodrill Prospect (No. 472 on Map II),** located on Laurel Creek, 0.2 mile southwest of Laurel Creek, at an elevation of 1670′ B., had fallen shut, no report having been obtained as to the thickness of the coal.

The **B. F. Dodrill Prospect (No. 473 on Map II),** located on Laurel Creek, 0.3 mile southward from Wainville, had fallen shut, its elevation being 1680′ B.

Lewis Green Farm Mine—No. 474 on Map II.

On Glade Run of Laurel Creek, 1.2 miles southward from Wainville; Eagle Coal; elevation, 1720′ B.

			Ft.	In.
Slate, dark				
Coal, medium-soft	1′	7″		
Slate, gray	0	2		
Coal, hard	0	8		
Slate, dark	0	2		
Coal, hard	0	7	3	2
Slate, pavement				

D. P. Kessler Farm Mine—No. 475 on Map II.

On Laurel Creek, 0.7 mile northwest of Arcola; Eagle Coal; elevation, 1885′ B.

			Ft.	In.
Sandstone, massive				
Slate, dark			2	0
Coal	1′	3″		
Slate, dark	0	1		
Coal	1	0	2	4
Slate, pavement				

Arcola Coal Company Prospect—No. 476 on Map II.

On Laurel Creek at Arcola; Eagle Coal; elevation, 1935′ B.

			Ft.	In.
Sandstone, massive				
Slate, dark			2	0
Coal	1′	1½″		
Slate	0	0½		
Coal	1	0	2	2
Slate, pavement				

The two following exposures were noted in perpendicular railroad cuts, thicknesses being estimated by eye:

Baltimore and Ohio Railroad Company Exposure—No. 477 on Map II.

On Laurel Creek, 0.2 mile northwest of Jack; Eagle Coal; elevation, 1950′ B.

			Ft.	In.
Sandstone, shaly, Eagle			15	0
Coal, estimated	1′	0″		
Slate, estimated	0	1		
Coal, estimated	1	0	2	1
Fire clay shale			8	0
Sandstone, massive, cliff, to grade			30	0

Baltimore and Ohio Railroad Company Exposure—No. 478 on Map II.

On Laurel Creek, opposite Jack; **Eagle Coal**; elevation, 1955′ B.

		Ft.	In.
Sandstone, shaly, **Eagle**		20	0
Coal, estimated	1′ 2″		
Slate, estimated	0 1		
Coal, estimated	1 1	2	4
Fire clay shale, with ferriferous limestone		2	0
Shale, sandy		14	0
Coal. Little Eagle		0	6
Fire clay shale		5	0
Sandstone, to grade		2	0

Baltimore and Ohio Railroad Company Prospect—No. 479 on Map II.

On Laurel Creek, 0.2 mile southwest of Jack; **Eagle Coal**; elevation, 1960′ B.

		Ft.	In.
Sandstone			
Coal, soft	1′ 3″		
Slate, bony	0 1		
Coal, soft	0 11	2	3
Slate, pavement			

Baltimore and Ohio Railroad Company Exposure—No. 480 on Map II.

On Laurel Creek, 0.3 mile southwest of Jack; **Eagle Coal**; elevation, 1975′ B.

		Ft.	In.
Sandstone, massive			
Coal		1	0
Fire clay shale		3	0
Coal		0	6
Shale, dark		10	0
Coal	1′ 4″		
Slate, black	0 1		
Coal	0 11	2	4
Fire clay shale		2	0
Sandstone, shaly		4	0
Shale, sandy, to grade		6	0

P. F. Kellar Farm Mine—No. 481 on Map II.

On McAvoy Run of Laurel Creek, 0.5 mile south of Jack; **Eagle Coal**; elevation, 1982′ B.

			Ft.	In.
Shale, dark			4	0
Coal, cannel	0′	1½″		
Coal, soft	1	1		
Slate, bony	0	1½		
Coal, soft	1	3	2	7
Slate, pavement				

Coal Exposure—No. 482 on Map II.

On McAvoy Run of Laurel Creek, 0.6 mile southeast of Jack; **Eagle Coal**; elevation, 1970′ B.

			Ft.	In.
Shale, sandy				
Coal	1′	0″		
Slate, dark	0	2		
Coal	0	4		
Slate, dark	0	2		
Coal	0	8	2	4
Shale, pavement				

L. W. McAvoy Farm Mine—No. 483 on Map II.

On McAvoy Run, 2.3 miles southeast of Jack; **Eagle Coal**; elevation, 2205′ B.

			Ft.	In.
Sandstone, massive				
Coal and slate, interlaminated	0′	6″		
Coal, medium-soft	2	0	2	6
Slate, pavement				

The **F. M. Blankenship Farm Mine** (No. 484 on Map II), located on McAvoy Run of Laurel Creek, 1.7 miles northwest of Bolair, at an elevation of 2305′ B., had fallen shut, the coal being reported 2′ 6″ thick, slaty at the top.

The **F. M. Blankenship Farm Mine** (No. 485 on Map II), located on a branch of McAvoy Run of Laurel Creek, 1.8 miles westward from Bolair, measured 2′ 3″ of clean, soft coal, with an elevation of 2380′ B.

O. B. Miller Farm Mine—No. 486 on Map II.

On a short branch of Laurel Creek, 0.5 mile southwest of Jack; Eagle Coal; elevation, 1975′ B.

			Ft.	In.
Shale, sandy, Newlon			10	0
Coal, soft, good	1′	2″		
Slate, dark	0	1		
Coal	1	2	2	5
Slate, pavement				

Farm Mine No. 487 on Map II, located on Laurel Creek, 0.7 mile southwest of Jack, at an elevation of 1995′ B., had fallen shut, the thickness of the coal not being learned.

Coal Exposure—No. 488 on Map II.

On Given Run, 1.4 miles southeast of Jack; Eagle Coal; elevation, 2065′ B.

			Ft.	In.
Sandstone, shaly				
Coal	1′	3″		
Slate	0	2		
Coal	0	7		
Slate	0	2		
Coal	0	10	3	0
Slate, bony			0	6
Shale, sandy, dark, with coal streaks			15	0
Sandstone, massive, in creek.				

David Johns Farm Mine—No. 489 on Map II.

On Given Run of Laurel Creek, 1.5 miles southeast of Jack; Eagle Coal; elevation, 2080′ B.

			Ft.	In.
Sandstone, shaly				
Coal, soft	1′	3″		
Slate, bony	0	3		
Coal	0	2		
Slate, dark	0	2		
Coal	0	9	2	7
Slate, pavement and concealed to creek			10	0

Farm Mine (No. 490 on Map II), located on Laurel Creek, 0.5 mile northeast of Marcus, at an elevation of 2005′ B., had fallen shut, no report having been obtained as to the thickness of the coal.

On Birch River the Eagle Coal has been prospected and mined for local fuel at several points, the following openings having been observed:

Coal Prospect No. 491 on Map II, located on Birch River just south of Skyles, at an elevation of 1260′ B., had fallen shut, its thickness not being learned.

Coal Prospect No. 492 on Map II, located on Birch River, just above the mouth of Rich Fork and 2.5 miles northwest of Boggs, at an elevation of 1340′ B., had fallen shut, no report having been obtained as to the thickness of the coal.

D. S. Barnett Farm Mine—No. 493 on Map II.

On Birch River, 2.2 miles northwest of Boggs; **Eagle Coal**; elevation, 1385′ B.

			Ft.	In.
Shale, dark, sandy, Newlon			15	0
Coal, soft	1′	3″		
Coal, slaty	0	2		
Coal, soft	1	7	3	0
Slate, pavement				

D. W. Barnett Farm Mine—No. 494 on Map II.

On Birch River, 1.7 miles northwest of Boggs; **Eagle Coal**; elevation, 1470′ B.

			Ft.	In.
Slate, black				
Coal, soft	1′	10″		
Coal, bony	0	5		
Coal, medium-hard	1	6	3	9
Slate, pavement, and concealed			10	0
Sandstone, massive			25	0
Concealed			20	0
Sandstone, massive, cliff, to river			45	0

A section once measured at the above opening by J. W. Paul, and differing somewhat from that obtained by the writer, is as follows:

			Ft.	In.
Fire clay roof				
1. **Coal**	1′	11″		
2. Slate	0	1½		
3. **Coal**	0	10		
4. Slate and sulphur	0	0¾		
5. **Coal**	0	9		
6. **Coal**, slaty	0	3	3	11¼

A sample (No. I) was collected from the above opening by Mr. Paul, omitting Nos. 2, 4, and 6 of section, the composition of which, as reported to the Survey by Geo. F. Duck, of Clearfield, Pa., is as follows:

	Per cent.
Moisture	8.36
Volatile Matter	32.54
Fixed Carbon	52.47
Ash	6.63
Total	100.00
Sulphur	1.66

The following opening had fallen shut, the measurement of its section as given below being reported by J. W. Paul:

C. B. Fowler Farm Mine—No. 495 on Map II.

On Barnet Run of Birch River, 0.6 mile southwest of Boggs; **Eagle Coal**; elevation, 1650′ B.

			Ft.	In.
Coal	0′	11″		
Slate	0	1		
Coal	1	5	2	5

Coal Prospect No. 496 on Map II, located on Birch River, 0.3 mile northwest of Boggs, at an elevation of 1570′ B., had fallen shut, there being only a small amount of coal visible on the dump.

Coal Prospect—No. 497 on Map II.

On Birch River, 3.6 miles southeast of Boggs; **Eagle Coal**; elevation, 1820′ B.

			Ft.	In.
Shale, sandy				
Coal	0′	4″		
Shale, sandy	0	8		
Coal, slaty	0	6		
Shale, sandy, ferriferous	3	0		
Coal	0	8	5	2
Shale			5	0
Sandstone, to creek			30	0

The **Keystone Lumber and Mining Company Prospect** (No. 498 on Map II), located on Birch River, 2.7 miles northwest of Cowen, measured 2′ 6″ of clean, medium-soft coal, at an elevation of 1875′ B.

PLATE XXVII.—View of J. F. Smith farm on Price Glade Run, 1.5 miles east of Cowen, showing typical glade held up by Lower Gilbert and other massive sandstones.

The Keystone Lumber and Mining Company Prospect (No. 499 on Map II), located on Birch River, 2.5 miles northwest of Cowen, at an elevation of 1865′ B., had fallen shut, its thickness not being learned.

Smoot Lumber Company Farm Mine—No. 500 on Map II.

On Birch River, 2.2 miles northwest of Cowen; Eagle Coal; elevation, 1920′ B.

			Ft.	In.
Shale, dark, sandy				
Coal, soft	0′	6½″		
Slate, dark	0	0½		
Coal, medium-hard	1	1		
Slate, dark	0	1		
Coal, soft	1	4	3	1
Slate, pavement				

Smoot Lumber Company Farm Mine—No. 501 on Map II.

On Birch River, 2.1 miles northwest of Cowen; Eagle Coal; elevation, 1930′ B.

			Ft.	In.
Shale, sandy, Newlon			10	0
Coal, soft	1′	4 ″		
Slate, black	0	0½		
Coal	0	11½	2	4
Slate, pavement				

Coal Prospect No. 502 on Map II, located on Birch River, 1.9 miles northwest of Cowen, at an elevation of 1985′ B., had fallen shut, the thickness of the coal not being learned.

Birch River Coal Company Farm Mine—No. 503 on Map II.

On Birch River, 1.8 miles northwest of Cowen; Eagle Coal; elevation, 1995′ B.

			Ft.	In.
Shale, dark, sandy				
Coal, hard	1′	0″		
Coal, soft, good	1	3		
Coal, hard, bony	0	4		
Coal, medium-hard	2	0	4	7
Slate, pavement				

A sample (No. D) apparently from this mine, was once

taken by J. W. Paul, the composition of which, as reported by Geo. F. Duck, is as follows:

	Per cent.
Moisture	1.10
Volatile Matter	31.99
Fixed Carbon	51.15
Ash	15.76
Total	100.00
Sulphur	2.99

Birch River Coal Company Farm Mine—No. 504 on Map II.

On Birch River, 1.7 miles northwest of Cowen; **Eagle Coal**; elevation, 2000′ B.

			Ft.	In.
1. Shale, dark, sandy, **Newlon**			75	0
2. **Coal**, soft	1′	6″		
3. Slate, black	0	0½		
4. **Coal**, soft	1	5½	3	0
5. Slate, pavement				

A sample (No. 184R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 504** in the Survey Table of Coal Analyses at the end of this Chapter.

Some scattered prospects have been made on the Gauley drainage, the following having been noted:

S. T. Morton Farm Mine—No. 505 on Map II.

On Strouds Creek, 0.5 mile southwest of Strouds; **Eagle Coal**; elevation, 2145′ B.

			Ft.	In.
Shale, sandy				
Coal			0	6
Concealed and sandy shale			7	0
Coal	0′	5″		
Shale, dark	3	0		
Coal, soft	1	9	5	2
Slate, pavement				

Coal Prospect No. 506 on Map II, located on Coon Creek, 1.5 miles northward from Camden-on-Gauley, measured 1′ 3″ of medium-soft coal, its elevation being 2210′ B.

The **Norman Barnett Prospect (No. 507 on Map II)**, lo-

cated on a branch of Big Ditch Run, 1.5 miles northeast of Camden-on-Gauley, at an elevation of 2285′ B., had fallen shut, the coal having been mined by stripping at this point, with a reported thickness of 1′ 8″.

Coal Stripping No. 508 on Map II, located on Big Ditch Run, 1.1 miles southwest of Cowen, at an elevation of 2235′ B., had fallen shut, the thickness of the coal not being learned.

On the head of a short branch of Gauley, 0.2 mile southwest of Upper Glade, a water well drilled on the land of **Thomas. Given** was reported to have found a coal 3′ 0″ thick at a depth of 30 feet, the elevation of the coal being 2302′ B., and making it belong at the Eagle horizon.

Quantity of Eagle Coal Available.

The following table, prepared by Miss Buchanan, from a planimetric measurement of the outcrop on Map II, gives the probable amount of Eagle Coal in the county:

Probable Amount of Eagle Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	2.5	71.70	45,888	4,997,203,200	199,888,128
Holly	2.5	73.40	46,976	5,115,686,400	204,627,456
Fork Lick	2.5	26.45	16,928	1,843,459,200	73,738,368
Glade	2.5	113.35	72,544	7,900,041,600	316,001,664
Totals		284.90	182,336	19,856,390,400	794,255,616

LOWER WAR EAGLE COAL.

The Lower War Eagle Coal, previously discussed in Chapter VI, page 179, is of apparent value in a restricted area north of the center of the county, embraced in portions of Hacker Valley and Holly and in a narrow belt along the northern edge of Fork Lick District. In this region it sometimes has a thickness of two feet or more, being usually a soft, pure coal without partings. Figure 17 shows its areal extent in the region where it is considered to have an eventual commercial

value. Its outcrop is not shown on Map II, but its position at any particular point may be determined with fair accuracy by its relationship to the Eagle Coal above and the Gilbert below, both of which are cropped on the map, the necessary stratigraphic intervals being detailed in the Table of Intervals above and below the Eagle Coal, page 56.

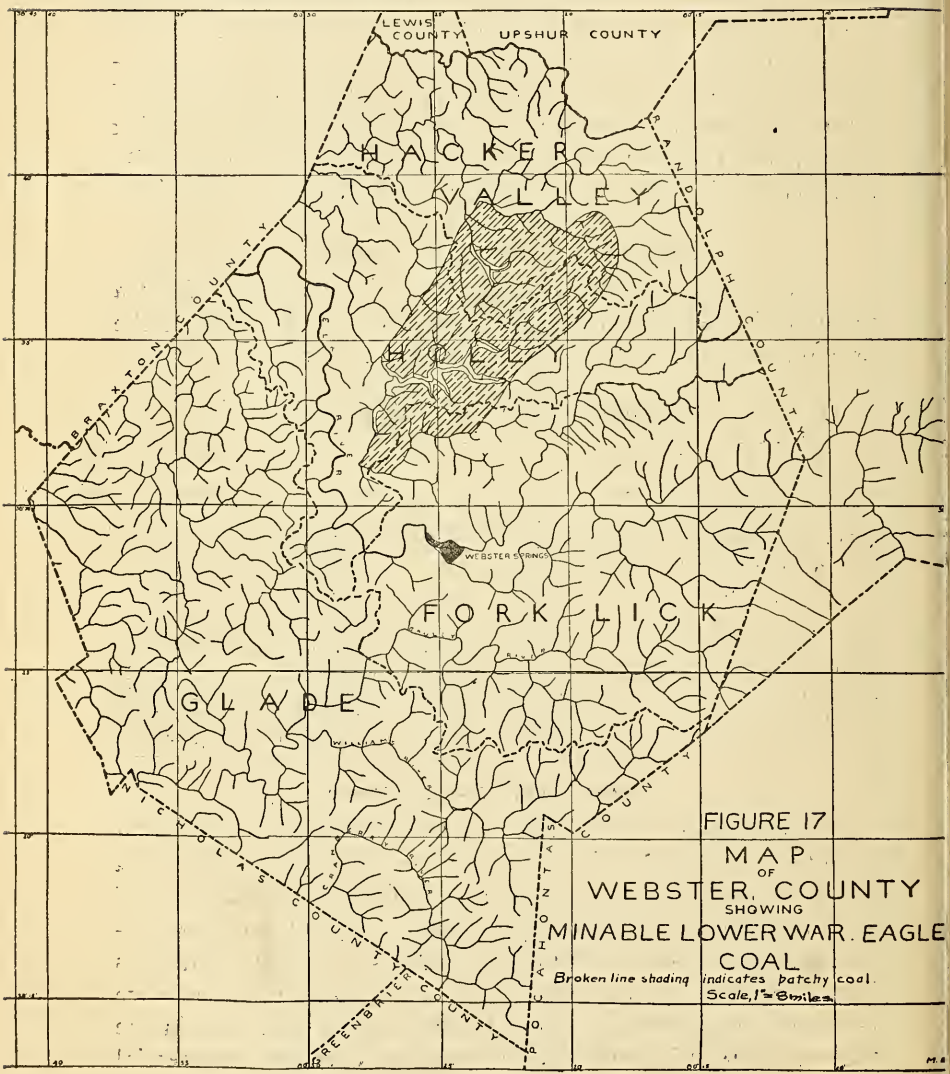


FIGURE 17

MAP OF WEBSTER COUNTY SHOWING MINABLE LOWER WAR EAGLE COAL

Broken line shading indicates patchy coal.

Scale, 1" = 8 miles.

Lower War Eagle Coal, Hacker Valley District.

In Hacker Valley District the Lower War Eagle Coal is found on certain tributaries of Holly River in the southern portion next to the Holly District Line, the following openings having been noted:

The **Mayton Lumber Company Prospect (No. 519 on Map II)**, located on a branch of Hodam Creek of Left Fork of Holly, 1 mile northwest of Hodam village, at an elevation of 1575′ B., had fallen shut, the coal being reported as 2 feet thick with 4″ of slate near the middle of the bed.

Everett Hamrick Farm Mine—No. 520 on Map II.

On Hodam Creek, 0.4 mile north of Hodam village; **Lower War Eagle Coal**; elevation, 1675′ B.

	Ft.	In.
Sandstone, massive, **Lower War Eagle**	20	0
Coal	2	2
Slate, pavement		

A sample (No. 23) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 520** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter. The analysis reveals a coal high in both sulphur and ash.

The **Everett Hamrick Prospect (No. 521 on Map II)**, located on Hodam Creek just west of Hodam village, at an elevation of 1695′ B., had fallen shut, the coal, according to Ballard Carpenter, having a thickness of 1′ 4″.

The **Eakin Pugh Farm Mine (No. 522 on Map II)**, located on Big Lick Fork of Hodam Creek, 0.8 mile northeast of Hodam village, measured 2′ 0″ of clean, soft coal, its elevation being 1695′ B.

The **A. J. Cowger Heirs Farm Mine (No. 523 on Map II)**, located on Left Fork of Holly at the mouth of Big Run and 2.3 miles southwest of Penbro, measured 2′ 3″ of clean, medium-soft coal, its elevation being 1905′ B.

The **Roy Mace Prospect (No. 524 on Map II)**, located on Left Fork of Holly, 2 miles southwest of Penbro, at an ele-

vation of 2015′ B., had fallen shut, the coal being reported 1′ 6″ thick.

Coal Exposure No. 525 on Map II, located on Left Fork of Holly, 2 miles southwest of Penbro, at an elevation of 2045′ B., measured 1′ 6″ of coal, coming 28 feet above the level of Holly River.

Lower War Eagle Coal, Holly District,

In Holly District the Lower War Eagle was noted at a few points on the waters of Right Fork of Holly River in the region southeast of Diana, its blossom being recorded in the section for Diana, page 81.

Coal Prospect—No. 526 on Map II.

On Grassy Creek, 1 mile northeast of Summit Station; **Lower War Eagle Coal;** elevation, 1600′ B.

	Ft.	In.
Sandstone, massive, Lower War Eagle	5	0
Slate, bony	1	0
Coal, medium-soft	1	8
Slate and concealed	5	0
Sandstone, massive, cliff	55	0
Concealed to creek	10	0

Coal Prospect—No. 527 on Map II.

On Grassy Creek, 0.3 mile northeast of Summit Station; **Lower War Eagle Coal;** elevation, 1645′ B.

		Ft.	In.
Shale, sandy		10	0
Coal, slaty	0′ 4″		
Coal, medium-hard	1 1	1	5
Slate, pavement			

The Dale Williams Farm Mine (No. 528 on Map II), located on Mudlick Run of Right Fork of Holly, 1 mile southwest of Jumbo, at an elevation 1745′ B., had partly fallen shut, its apparent thickness as shown by the mine props being about 2 feet.

In the section for Jumbo, published on page 83, the blos-

som of the coal is recorded, the same having been noted along the road leading toward Hacker Valley.

Lower War Eagle Coal, Fork Lick and Glade Districts.

In Fork Lick District no openings in the Lower War Eagle were observed, its horizon being high in the mountains. Because of the close proximity of the northern edge of the district to that portion of Holly where openings were found, a limited area of the coal is indicated on Figure 17.

In Glade District no minable coal was found at the Lower War Eagle horizon, the two following exposures having been noted:

Coal Exposure No. 529 on Map II, located on Laurel Fork of Birch River, 1.2 miles northeast of Boggs, at an elevation of 1603′ B., measured 0′ 4″, as exhibited in the section for Boggs, page 111.

Coal Exposure No. 530 on Map II, located on the Cowen road, 1 mile northeast of Camden-on-Gauley, at an elevation of 2245′ B., measured a total of 2′ 1″, being much split up with slate, as detailed in the section for Camden-on-Gauley, page 114.

Quantity of Lower War Eagle Coal Available.

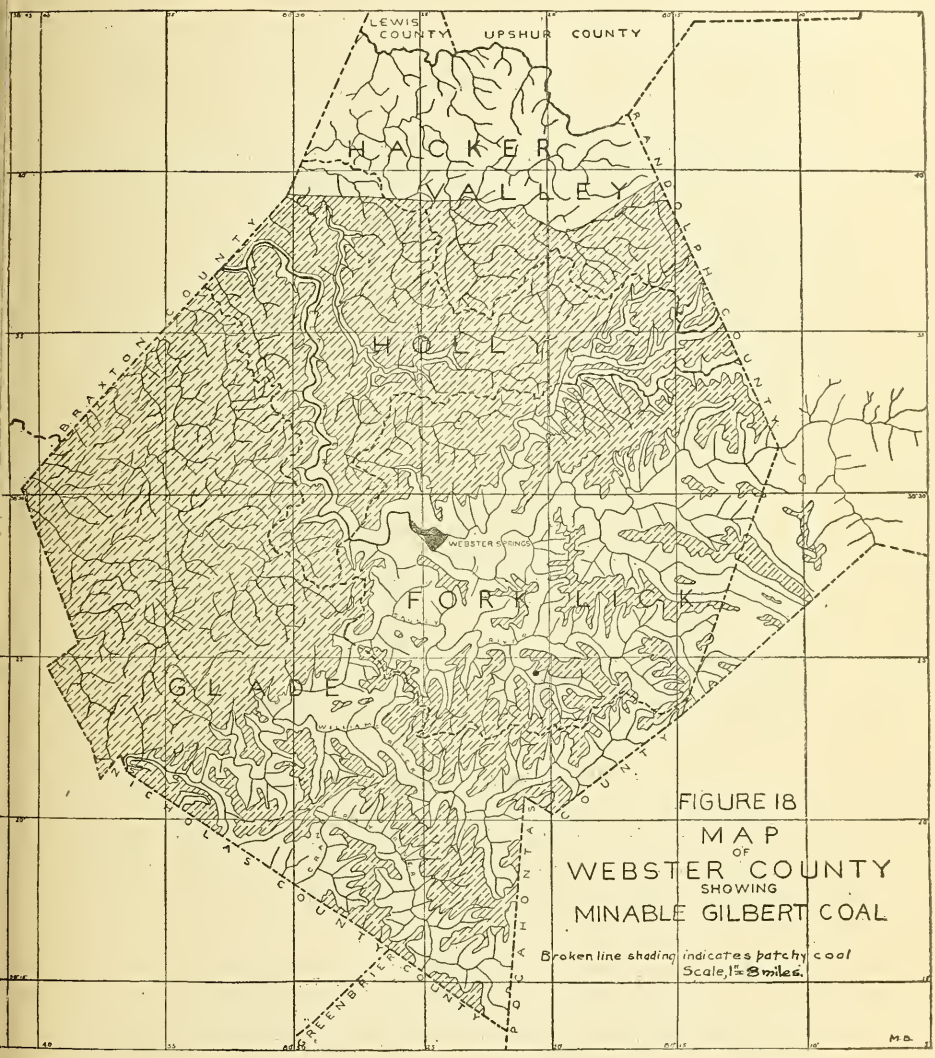
The following table, prepared by Miss Buchanan, based on a close estimate of the area of minable coal as determined from its relationship to the Eagle and Gilbert Coals, shows the probable amount of Lower War Eagle Coal in the county:

Probable Amount of Lower War Eagle Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	1.5	15.10	9,664	631,445,760	25,257,831
Holly	1.5	20.85	13,344	871,896,960	34,875,878
Fork Lick	1.5	3.30	2,112	137,998,080	5,519,923
Totals		39.25	25,120	1,641,340,800	65,653,632

GILBERT COAL.

The Gilbert Coal, previously discussed in Chapter VI, page 182, was noted at various scattered points over the county, being patchy in its development, its horizon being frequently occupied by shale and at other points by a bed of coal 1 to 4 feet in thickness. In the northern end of Hacker Valley District, it seems to disappear almost completely. Figure 18 shows the general region over which exposures were noted, its patchy nature being indicated by broken line shading. On Map II its outcrop is delineated for that portion of the county where openings were found, as well as in the strip of southwestern Randolph treated in this Report. As a rule the coal is soft and columnar, without shale partings.


LEWIS COUNTY
UPSHUR COUNTY
HACKER VALLEY
HOLLY
WEBSTER SPRINGS
FORK LICK
GLADE
BRAXTON COUNTY
NICHOLAS COUNTY
GREENBRIER COUNTY
FIGURE 18
MAP
OF
WEBSTER COUNTY
SHOWING
MINABLE GILBERT COAL
Broken line shading indicates patchy coal
Scale, 1 in = 8 miles.

Gilbert Coal, Hacker Valley District.

In Hacker Valley District the Gilbert Coal was noted at several points on the waters of Holly River, and at a few points in that portion of the district covered by the drainage of Sugar Creek, which is tributary to Elk River.

At **Coal Expcsure No. 531 on Map II,** located on Fall Run of Left Fork of Holly River, 0.3 mile southeast of Penbro, a coal 1′ 0″ thick was noted at an elevation of 2205′ B., that seems to correlate with the Gilbert.

At **Coal Exposure No. 532 on Map II,** located on Fall Run of Left Fork of Holly, 0.9 mile southeast of Penbro, the same coal was noted at an elevation of 2260′ B., measuring 0′ 8″ in thickness.

The following opening was noted in the extreme southeastern end of the district:

Holly Lumber Company Farm Mine—No. 533 on Map II.

On Little Sugar Creek, 4.2 miles northeast of Skelt; **Gilbert Coal;** elevation, 2645′ B.

	Ft.	In.
Sandstone, massive		
Coal, medium-soft, columnar at base	2	7
Slate, pavement		

Gilbert Coal, Holly District.

In Holly District the Gilbert Coal was noted at points on the drainage of Right Fork of Holly and in the valley of Elk River, as well as on some of its tributaries.

Coal Exposure—No. 534 on Map II.

On Right Fork of Holly River, 0.3 mile northwest of Salisbury Station; **Gilbert Coal;** elevation, 1105′ B.

	Ft.	In.
Sandstone, massive, **Lower Gilbert**	20	0
Shale, sandy, **Gilbert**	15	0
Coal, Gilbert	0	10
Sandstone, massive	10	0

Lawrence Cochran Farm Mine—No. 535 on Map II.

On Right Fork of Holly River, 0.2 mile northeast of Big Run Station; **Gilbert Coal**; elevation, 1205′ B.

	Ft.	In.
Sandstone, shaly	7	0
Shale, sandy, dark	2	0
Coal	1	4
Fire clay shale		

Andrew McCourt Heirs Farm Mine—No. 535 on Map II.

On west side of Elk River, 0.8 mile west of Summit Station; **Gilbert Coal**; elevation, 1505′ B.

	Ft.	In.
Shale, dark	2	0
Slate, black, cannel	0	6
Coal, soft	0	6
Slate, pavement		

Coal Prospect (No. 536 on Map II), located on Sugar Creek, 0.9 mile southwest of Skelt post-office, at an elevation of 2240′ B., had fallen shut, no report having been obtained as to the thickness of the coal.

Gilbert Coal, Fork Lick District.

In Fork Lick District only two prospects were observed in the Gilbert Coal, but its presence at certain points in Hacker Valley and Holly Districts to the northeast and in Glade to the southwest would indicate that a search at the proper horizon along the high mountains of the Elk and Gauley Valleys would reveal it, there having been no incentive to prospect for it owing to the presence of the thick New River coals at lower and more accessible horizons.

The following prospects were noted:

The **Thomas Bender Farm Mine (No. 536A on Map II)**, located on Little Grassy Creek, 1.8 miles southward from Orndoff, at an elevation of 1975′ B., had fallen shut, its thickness being reported 2′ 6″ of hard coal.

Coal Prospect—No. 536B on Map II.

On Spring Run of Back Fork of Elk River, 1.3 miles northwest of Woodzell; **Gilbert Coal**; elevation, 2310′ B.

			Ft.	In.
Sandstone, massive				
Coal	1′	0″		
Shale, gray	0	4		
Coal	0	5	1	9
Fire clay shale			3	0
Sandstone, massive				

Its blossom was observed at a spring near the top of the mountain, 1 mile northward from Three Forks of Gauley River, and 0.2 mile west of the Randolph County Line, at an elevation of 3660′ B., as noted in the section for Three Forks of Gauley, page 107.

Gilbert Coal, Glade District.

In Glade District the Gilbert has been prospected at certain points in the Gauley and Williams River drainage basins, the following openings having been noted:

L. T. Morton Farm Mine—No. 537 on Map II.

On a short branch of Gauley River, 0.6 mile northward from Allingdale; **Gilbert Coal**; elevation, 2070′ B.

			Ft.	In.
Sandstone, shaly				
Coal, slaty	0′	5″		
Shale, dark	2	0		
Coal, soft	0	8		
Shale, gray	2	2		
Coal, soft	1	0	6	3
Concealed, pavement?				

S. H. Fleming Farm Mine—No. 538 on Map II.

On a short branch of Coon Creek, 1.2 miles northward from Camden-on-Gauley; **Gilbert Coal**; elevation, 2120′ B.

	Ft.	In.
Slate, dark		
Coal, soft	2	0
Shale, gray, pavement, visible	3	0

A sample (No. 193R) was collected at this opening, the composition of which is published under **Mine No. 538** in the Survey Table of Coal Analyses at the end of this Chapter. The analysis shows a coal high in sulphur and somewhat high in ash. At this point the coal has been mined on a considerable scale for local use in Camden-on-Gauley and the surrounding neighborhood, the gray shale at the bottom being taken up to secure head room.

At **Coal Exposure No. 539 on Map II**, located on the Cranberry Ridge, south of Gauley River and 1.4 miles southeast of Gauley Mills, the coal is visible in the public road at an elevation of 2540′ B., its thickness as measured at the crop being 1′ 8″.

The **Joseph Prater Prospect (No. 540 on Map II)**, located on Big Laurel Creek of Gauley, 1.1 miles northeast of Coe, at an elevation of 2830′ B., had fallen shut, the coal never having been faced up according to the owner.

The **George Coe Prospect (No. 541 on Map II)**, located on Big Laurel Creek, 1.3 miles northeast of Coe, at an elevation of 2865′ B., had fallen shut, the coal being reported 3 feet thick, with a streak of slate near the middle, the seam being covered by the great Lower Gilbert Sandstone ledge that forms the top of the ridge for many miles in this locality.

The **Joseph Prater, Jr., Prospect (No. 542 on Map II)**, located on the head of a branch of Adkins Rockhouse Branch of Gauley River, 1.7 miles northeast of Coe, at an elevation of 2795′ B., had fallen shut, the coal being reported 1′ 5″ thick by the owner.

Baltimore and Ohio Railroad Exposure—No. 543 on Map II.

On Big Ditch Run of Gauley River, 1.4 miles southward from Cowen; **Gilbert Coal**; elevation, 2215′ B.

	Ft.	In.
Sandstone, massive		
Shale, sandy	5	0
Coal, soft	1	4
Fire clay shale and concealed to grade	3	0

The **Dean Mills Prospect (No. 544 on Map II)**, located on the ridge west of Craig Run and south of Williams River

and 1.5 miles southwest of Dyer, at an elevation of 2780′ B., measured 1′ 5″ of coal.

Gilbert Coal, Mingo District, Randolph County.

In that triangular portion of Mingo District, Randolph County, lying south of Elk River and between Webster and Pocahontas Counties, no prospects, so far as known, have been made at the Gilbert horizon, the region being mostly covered with a dense forest growth, much of which has not been disturbed. This region, however, should have much the same coals as those found south of the Gauley River in Glade District, Webster, and the Gilbert Coal is therefore indicated on Figure 18, in the belief that prospecting at the proper horizon would reveal it.

Quantity of Gilbert Coal Available.

The following table, compiled by Miss Buchanan from a planimetric measurement of the outcrop on Map II, shows the probable amount of Gilbert Coal by districts in Webster and in that portion of Randolph embraced in this Report, due allowance having been made in the thickness column for the patchy nature of the coal:

Probable Amount of Gilbert Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	1	27.00	17,280	752,716,800	30,108,672
Holly	1	83.05	53,152	2,315,301,120	92,612,045
Fork Lick	1	56.35	36,064	1,570,947,840	62,837,913
Glade	1	148.95	95,328	4,152,487,680	166,099,507
Totals		315.35	201,824	8,791,453,440	351,658,137
Portion of Mingo District of Randolph County, south of Valley Fork of Elk	1	2.10	1,344	58,544,640	2,341,786
Totals		317.45	203,168	8,849,998,080	353,999,923

MINABLE COALS, NEW RIVER GROUP OF POTTSVILLE SERIES.

HUGHES FERRY (IAEGER) COAL.

The Hughes Ferry (Iaeger) Coal, previously discussed in Chapter VII, pages 192-3, is of value only in portions of the southwestern half of the county, mainly in portions of the drainage basins of Elk, Gauley, Williams, and Cranberry Rivers, and in the triangular strip of Mingo District, Randolph County, treated in this Report. Its thickness varies from 1 to 4 feet and its occurrence is somewhat patchy. When found in minable thickness it is a pure, soft coal, of the typical New River character. Its outcrop is shown on Map II for those regions where it is believed to be of value and Figure 19 indicates the areal extent of the same territory.

Hughes Ferry Coal, Holly District.

In Holly District the Hughes Ferry Coal has been prospected and mined at several points in the drainage of Back Fork of Elk River and Sugar Creek, where it reaches its best development in the county, the following openings having been noted:

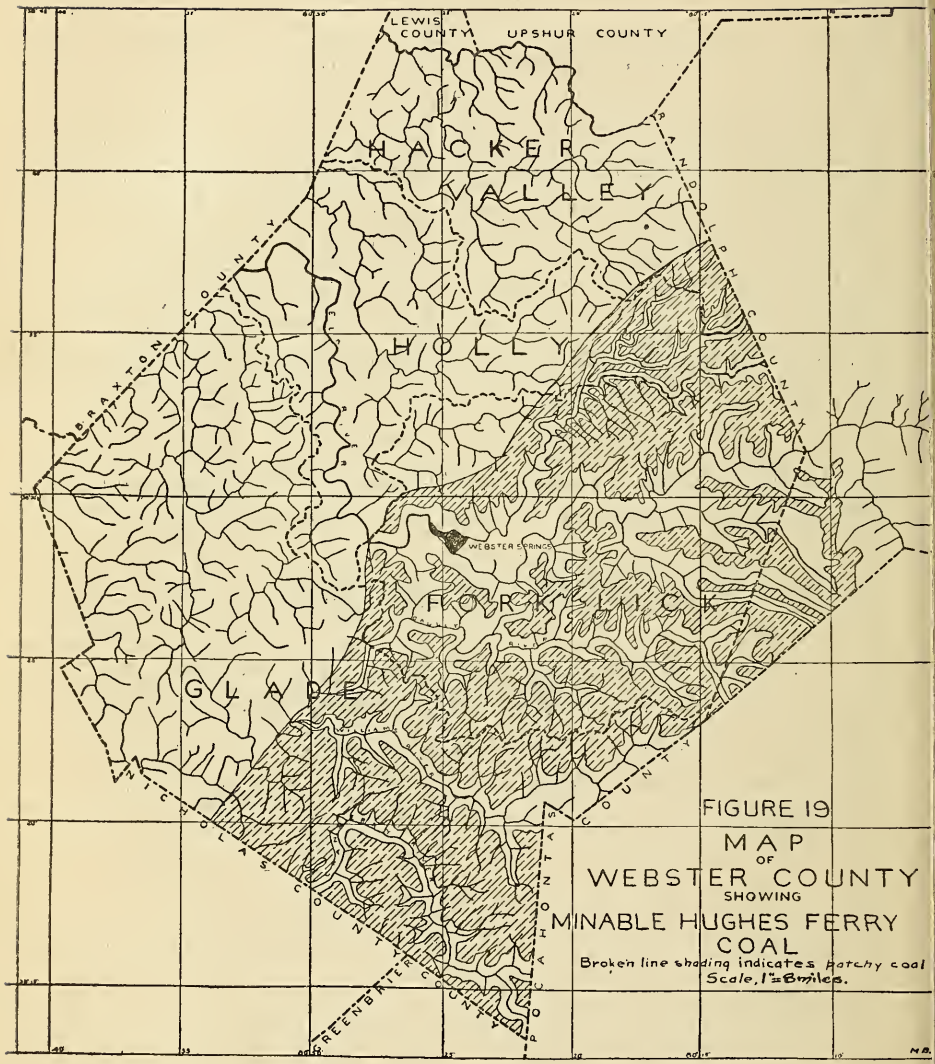


FIGURE 19

MAP
OF
WEBSTER COUNTY
SHOWING
MINABLE HUGHES FERRY
COAL

Broken line shading indicates patchy coal
Scale, 1"=8miles.

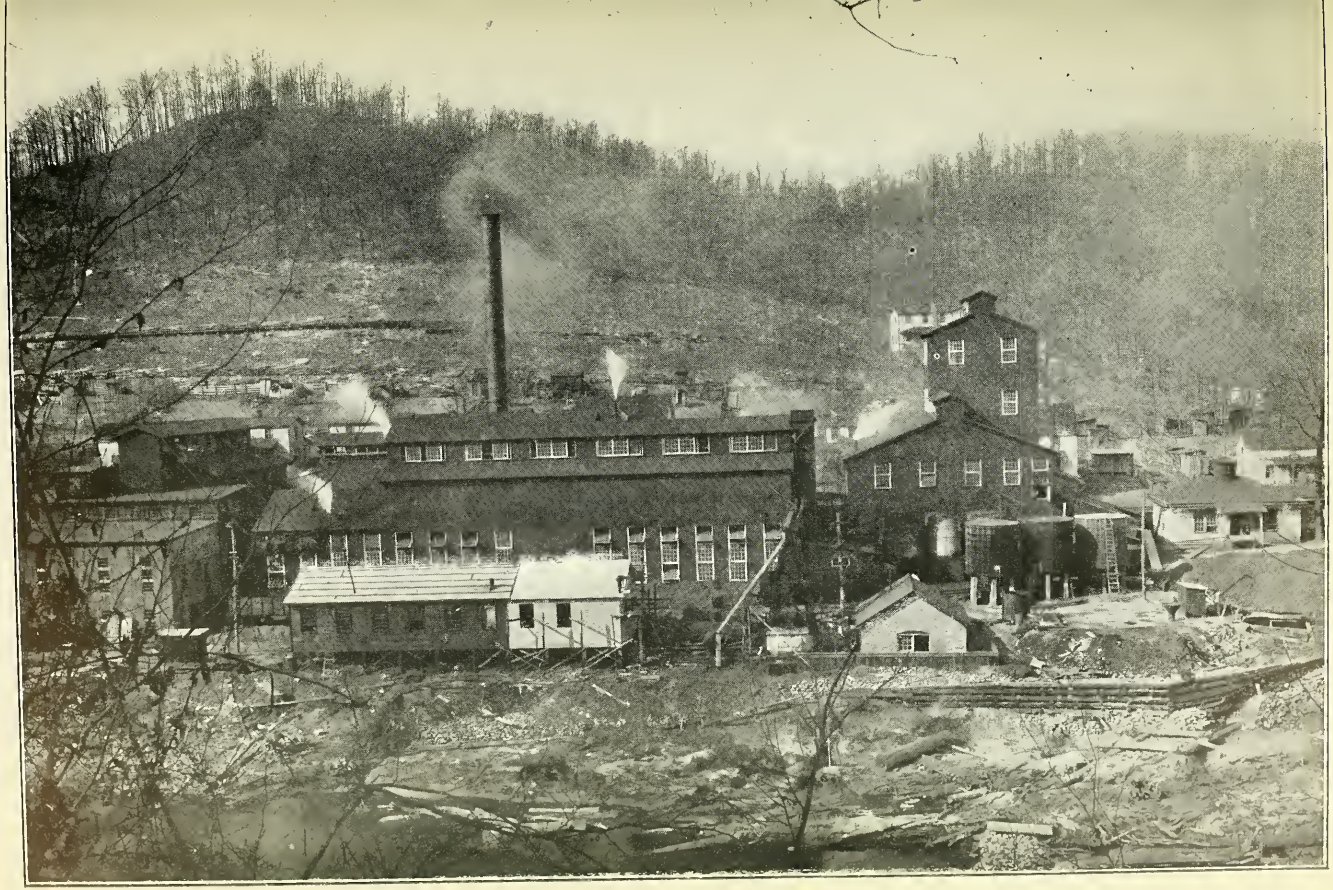


PLATE XXVIII.—West Virginia Waste Wood Chemical Company Plant at Gauley Mills; Gauley River in foreground; Topography of Pottsville Series.

Isaac Cogar Farm Mine—No. 553 on Map II.

On Sugar Creek, 0.5 mile southwest of Skelt Post-Office; **Hughes Ferry Coal**; elevation, 2115′ B.

	Ft.	In.
Shale, sandy	3	0
Coal, soft	3	0
Slate, pavement		

W. R. Cogar Farm Mine—No. 554 on Map II.

On Sugar Run of Sugar Creek, 0.3 mile north of Skelt Post-Office; **Hughes Ferry Coal**; elevation, 2090′ B.

	Ft.	In.
1. Sandstone, shaly	10	0
2. Slate, dark	1	0
3. **Coal**, medium-soft, columnar....3′ 8″ to	4	6
4. Slate, pavement		

A sample (No. 173R) was collected from No. 3 of section, the composition of which is published under **Mine No. 554** in the Survey Table of Coal Analyses at the end of this Chapter.

Welsh Colony Tract Exposure—No. 555 on Map II.

In a ravine on Mill Run of Sugar Creek, 4.7 miles southwest of Pickens; **Hughes Ferry Coal**; elevation, 2620′ B.

	Ft.	In.
Slate, dark		
Coal	2	2
Fire clay shale		

John Rusmisell Farm Mine—No. 556 on Map II.

On Mill Run of Sugar Creek, 1.3 miles above its mouth and 4.3 miles southwest of Pickens; **Hughes Ferry Coal**; elevation, 2560′ B.

	Ft.	In.
1. Slate, black		
2. **Coal**, medium-soft	2	8
3. Slate, pavement		

A sample (No. 214R) was collected from No. 2 of section the composition of which is published under **Mine No. 556** in the Survey Table of Coal Analyses at the end of this Chapter.

Hughes Ferry Coal, Fork Lick District.

In Fork Lick District the Hughes Ferry Coal was noted on certain tributaries of Elk, Gauley, and Williams Rivers, the following prospects having been observed:

Coal Prospect No. 557 on Map II, located on a short branch of Back Fork of Elk River, 1.6 miles northwest of Woodzell, at an elevation of 2120′ B., and seeming to represent the Hughes Ferry horizon, had fallen shut, no report as to the thickness of the coal having been obtained.

Holly Lumber Company Prospect—No. 558 on Map II.

On Cherry Root Run of Back Fork of Elk River, 1 mile northwest of Waneta; **Hughes Ferry Coal**; elevation, 2655′ B.

	Ft.	In.
Sandstone, massive, **Lower Nuttall**	55	0
Slate, dark	0	6
Coal, medium-soft	1	10
Slate, pavement		

The **A. H. Cummings Prospect (No. 559 on Map II),** located on Baltimore Run of main Elk River, 1.2 miles eastward from Bernardstown, measured 1′ 2″ of clean, soft coal at an elevation of 2835′ B.

The **Cherry River Boom and Lumber Company Prospect (No. 560 on Map II),** located on Gauley River southwest of the mouth of Turkey Creek and 4.6 miles eastward from Bolair, measured 1′ 2″ of coal, its elevation being 2725′ B.

Cherry River Boom and Lumber Company Exposure—No. 561 on Map II.

On the south side of Gauley River, 0.5 mile southeast of Jim Spring Run, and 7.1 miles eastward from Bolair; **Hughes Ferry Coal.**

	Ft.	In.
Slate, black		
Coal, Hughes Ferry (2950′ B.)	1	0
Shale, gray, concealed and slate, black	14	0
Coal (2935′ B.)	0	9
Slate, pavement		

The lower bench of coal may possibly represent the Lower Iaeger Coal, with a decreased interval between the two or it may be merely a second bench of the Hughes Ferry.

Hughes Ferry Coal, Glade District.

In Glade District the Hughes Ferry Coal has been prospected at a few points on Gauley and Williams Rivers, the following openings having been observed:

The **Cherry River Boom and Lumber Company Prospect (John C. Chafin Opening—No. 562 on Map II)**, located on Gauley River southwest of the mouth of Buckeye Branch and 2.6 miles eastward from Gauley Mills, had fallen shut, its thickness being reported by Mr. Chafin as 1′ 0″ to 1′ 2″ and its elevation being 2215′ B.

Cherry River Boom and Lumber Company Prospect—No. 563 on Map II.

On Gauley River, 0.6 mile southeast of the mouth of Williams River; **Hughes Ferry Coal**; elevation, 2195′ B.

	Ft.	In.
Sandstone, massive, **Lower Nuttall**	55	0
Coal, soft	1	4
Slate, pavement, and concealed	2	0
Sandstone, massive		

Cherry River Boom and Lumber Company Prospect (James Barger Opening)—No. 564 on Map II.

On Craig Run of Williams River, 1.2 miles southwest of Dyer; **Hughes Ferry Coal**; elevation, 2540′ B.

		Ft.	In.
Slate, black, with shell fragments (**Naiadites?**)		5	0
Coal, cannel	0′ 1″		
Coal, soft, columnar	0 9		
Slate, bony	0 4		
Coal, hard, bony	0 10	2	0
Slate, pavement			

Cherry River Boom and Lumber Company Prospect (J. C. Mullens Opening)—No. 565 on Map II.

On Little Fork of Williams River, 1.8 miles south of the Three Forks of Williams River; **Hughes Ferry Coal**; elevation, 3035′ B.

	Ft.	In.
1. Slate, black		
2. **Coal**, soft	3	5
3. Slate, black, bony	0	5
4. Shale, gray, pavement		

A sample (No. 207R) was collected from No. 3 of section, the composition of which is published under **Mine No. 565** in the Survey Table of Coal Analyses at the end of this Chapter.

The **Cherry River Boom and Lumber Company Prospect (J. C. Mullens Opening—No. 566 on Map II)**, located on Little Fork of Williams River, 1.4 miles southward from the Three Forks, measured 3′ 3″ of clean, soft coal, at an elevation of 3015′ B.

At the **Cherry River Boom and Lumber Company Prospect (No. 567 on Map II)**, located on Rocklick Branch of Williams River, 0.9 mile northward from the mouth of the branch or 6.4 miles northeast of the Three Forks of Williams, measured 1′ 3″ of coal, with an elevation of 3325′ B.

Hughes Ferry Coal, Mingo District, Randolph County.

In that portion of Mingo District, Randolph County, treated in this Report, no prospects were observed in the Hughes Ferry Coal, but its presence there is assumed on the basis of its occurrence in the adjoining region of Webster.

Quantity of Hughes Ferry Coal Available.

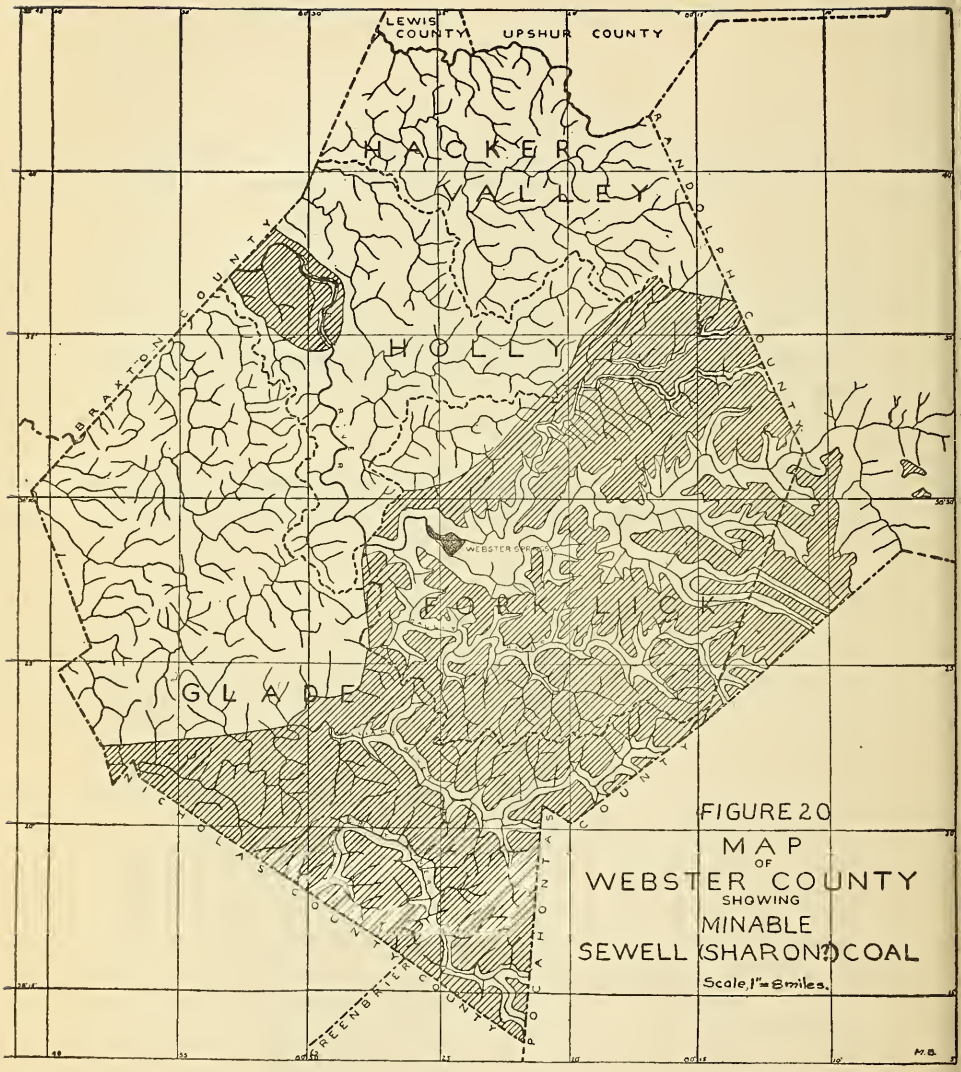
The following table, prepared by Miss Buchanan, from a planimetric measurement of the outcrop on Map II, gives the probable amount of Hughes Ferry Coal in Webster and in that portion of Randolph treated in this Report:

Probable Amount of Hughes Ferry Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	2	4.25	2,720	236,966,400	9,478,656
Holly	3	12.05	7,712	1,007,804,160	40,312,166
Fork Lick	2	69.05	44,192	3,850,007,040	154,000,282
Glade	2	69.30	44,352	3,863,946,240	154,557,850
Totals		154.65	98,976	8,958,723,840	358,348,954
Portion of Mingo District Randolph County South of Valley Fork	2	7.90	5,056	440,478,720	17,619,149
Totals		162.55	104,032	9,399,202,560	375,968,103

SEWELL (SHARON) COAL.

The Sewell Coal, previously discussed in Chapter VII, pages 204-5, is the most valuable and persistent bed of the New River Group in Webster, having a wide distribution over the southeastern half of the county, as well as being represented in the vicinity of Centralia along the western edge. Its thickness varies from 2 to 5 feet, being usually a clean, pure coal, without partings, and being low in sulphur, ash, and phosphorus. Figure 20 shows its areal extent in the region where it is known or believed to have a commercial value, and on Map II its outcrop is shown in the regions where it is above drainage and is of minable thickness. This bed has been used also as the basis of the red structure contours for the southeastern half of the county, making its further prospecting and exploitation a comparatively easy matter.


LEWIS COUNTY
UPSHUR COUNTY
HACKER VALLEY
HOLLY
BRAXTON COUNTY
RANDOLPH COUNTY
WEBSTER SPRINGS
FOLLICK
GLADE
NICHOLAS COUNTY
POCAHONTAS COUNTY
GREENBRIER COUNTY
FIGURE 20
MAP
OF
WEBSTER COUNTY
SHOWING
MINABLE
SEWELL (SHARON?) COAL
Scale, 1" = 8 miles.

Sewell Coal, Holly District.

In Holly District the Sewell Coal is above drainage along Elk River and some of its tributary streams. It is of apparent value over a small area in the region southeast of Centralia, as shown by Figure 20, thence passing southward up the river it seems to thin out to less than minable thickness for several miles, although further prospecting may reveal it in some of this region, but in the eastern end of the district, next to Randolph County, it again becomes a valuable seam of commercial proportions. The following openings were observed:

The following was noted by Ray V. Hennen, as previously published on page 769 of the Braxton and Clay report of the Survey:

Coal Prospect—No. 584 on Map II.

On the north side of Elk River, 3.5 miles eastward from Centralia; Sewell Coal; elevation, 1060′ B.

				Ft.	In.
Shale, dark, flaggy and sandy				7	0
Coal, soft	1′	0″			
Shale, with coal streaks at bottom	10	0			
Shale, with coal streaks	2	0			
Coal, slaty	2	0	Sewell "B"	15	0
Concealed and dark shale				29	0
Coal prospect, closed, Sewell, reported by W. T. Diggins as 52″ thick with 12″ cannel bone at top				4	4

The following opening was noted by Ray V. Hennen, as previously published on page 770 of the Braxton and Clay Report of the Survey:

J. E. McFarland Farm Mine—No. 585 on Map II.

On the east side of Elk River, 3.7 miles eastward from Centralia; Sewell Coal; elevation, 1065′ B.

			Ft.	In.
Shale, sandy, visible			5	0
Coal, cannelly, bony	1′	0″		
Coal, soft	3	4	4	4
Slate, floor				

A sample (No. 44) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 585** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The following coke test, furnished by the Survey by Mr. Teets, was made from a duplicate sample of the above coal, by the Bethlehem Steel Company at its Maryland Plant, Sparrows Point, Md.:

Bethlehem Steel Company, (Maryland Plant).
Coking Test Report No. 10,114.

Coal: No. 56; Sewell; shipped from Centralia by D. D. Teets, Jr., to E. Barnhart:

	V. M.	F. C.	Ash	S.	P.	B. T. U.	Dried at 212° F. B. T. U. Ash Free
Analysis:	29.05	64.90	6.05	0.75	.009	13,433	14,298

	T. C.	H.	O.	Ratio H-O	N.
	77.30	4.59	10.80	42.50	1.05

Gas:	CO_2	O_2	Ill.	CO	CH_4	H_2	N	C. P.	B. T. U.	Sp. Gr.
From Retort	9.0	.4	2.5	12.1	31.5	39.5	5.0	5.1	543	.539

Cu. Ft. gas per gross ton 9,837 — Candle Ft. per gross ton 50,169

Per cent. of Coke: 73.45

Notes: This is a semi-coking coal; coke has no structure.

Javis Brooks Prospect—No. 586 on Map II.

On the west side of Elk River, 3.3 miles eastward from Centralia; **Sewell Coal**; elevation, 1050′ B.

	Ft.	In.
Sewell "B" Coal, (see Mine No. 579)		
Shale, gray, with plant roots	2	0
Shale, dark, **Hartridge**	7	0
Coal, cannelly 1′ 1″		
Coal, soft 2 8	3	9
Shale, gray, with plant roots	2	0

A sample (No. 33) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 586** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Javis Brooks Farm Mine—No. 587 on Map II.

On Gulf Run of Elk River, 1.9 miles northwest of Big Run Station; **Sewell Coal**; elevation, 1055′ L.

			Ft.	In.
Sandstone, massive				
Shale, dark, **Hartridge**, with iron ore and **Lingula** fossils			1	6
Coal, cannelly	1′ 5″			
Coal, soft	3 1		4	6
Slate, dark, pavement				

A sample (No. 35) was collected from this opening by D. D. Teets, Jr, the composition of which is published under **Mine No. 587** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The following coke test, furnished the Survey by Mr. Teets, was made from a duplicate sample of the above coal by the Bethlehem Steel Company at its Maryland Plant, Sparrows Point, Md.:

Bethlehem Steel Company (Maryland Plant).
Coking Test Report No. 10,111.

Coal, No. 55; Sewell; shipped from Centralia by D. D. Teets, Jr., to E. Barnhart.

	V. M.	F. C.	Ash	S.	P.	B. T. U.	Dried at 212° F. B. T. U. Ash Free
Analysis:	30.48	63.35	6.17	0.75	.006	14,229	15,271

	T. C.	H.	O.	Ratio H-O	N.
	80.03	4.96	7.64	64.92	1.05

Gas:	CO_2	O_2	Ill.	CO	CH_4	H_2	N	C. P.	B. T. U.	Sp. Gr.
From Retort	4.0	.4	3.0	10.5	31.5	46.1	4.5	7.5	601	.480

Cu. Ft. gas per gross ton 10624 — Candle Ft. per gross ton 79680

Per cent. of Coke: 72.57

Notes: Coal contracted extremely on coking. Coke, fair.

Davis and Eakin Lumber Company Prospect—No. 588 on Map II.

On the south side of Elk River, 1.7 miles northwest of Big Run Station; **Sewell Coal**; elevation, 1965′ B.

			Ft.	In.
Sandstone, massive				
Coal, cannelly	0′ 11″			
Coal, soft	3 1		4	0
Slate, bony				

Davis and Eakin Lumber Company Prospect—No. 589 on Map II.

On the south side of Elk River, 1.6 miles northwest of Big Run Station; Sewell Coal; elevation, 1065′ B.

	Ft.	In.
Sandstone, massive		
Coal, soft	1	10
Slate, bony	0	10
Slate, pavement, and concealed	2	0
Sandstone, massive, to river	40	0

John E. Roller Farm Mine—No. 590 on Map II.

On the west side of Elk River, 1.1 miles westward from Big Run Station and 0.3 mile southwest of the Clifton Ford; Sewell Coal; elevation, 1065′ B.

		Ft.	In.
Sandstone, massive			
Shale, dark, with streaks of iron carbonate, Hartridge		5	0
Coal, cannelly	1′ 2″		
Coal, soft	3 10	5	0
Slate, bony, pavement			

A sample (No. 36) was collected from this opening by D. D. Teets, Jr., the composition of which is published under Mine No. 590 in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The following coke test, furnished the Survey by Mr. Teets, was made from a duplicate sample of the above coal by the Bethlehem Steel Company at its Maryland Plant, Sparrows Point, Md.:

Bethlehem Steel Company (Maryland Plant).

Coking Test Report No. 10,113.

Coal, No. 54; Sewell Coal; shipped from Centralia by D. D. Teets, Jr., to E. Barnhart.

	V. M.	F. C.	Ash	S.	P.	B. T. U.	Dried at 212° F. B. T. U. Ash Free
Analysis:	29.65	63.95	6.40	0.84	.008	13,876	14,824

	T. C.	H.	O.	Ratio H-O	N.
	80.00	4.91	7.78	63.10	1.17

Gas:	CO_2	O_2	Ill.	CO	CH_4	H_2	N	C. P.	B. T. U.	Sp. Gr.
From Retort	4.2	.4	2.9	11.8	31.2	45.4	4.1	7.1	570	.486

Cu. Ft. gas per gross ton 10,550 — Candle Ft. per gross ton 74,905

Per cent. of Coke: 73.21

Notes: Coal contracted upon coking. Coke, fair structure.

Benedum Brothers Farm Mine—No. 591 on Map II.

On a short branch of Elk River, 0.5 mile south of the Clifton Ford and 1 mile southwest of Big Run Station; Sewell Coal; elevation, 1080′ B.

			Ft.	In.
1. Sandstone, massive				
2. Coal, soft	2′ 7″			
3. Coal, harder, somewhat bony	1 0		3	7
4. Slate, pavement				

A sample (No. 180R) was collected from No. 2 of section the composition of which is published under Mine No. 591 in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 42) was collected by D. D. Teets, Jr., the composition of which is published under the same mine number (591) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The following coke test, furnished the Survey by Mr. Teets, was made from a duplicate sample of the above coal by the Bethlehem Steel Company at its Maryland Plant, Sparrows Point, Md.:

Bethlehem Steel Company (Maryland Plant).

Coking Test Report No. 10,115.

Coal, No. 57; Sewell Coal; shipped from Centralia by D. D. Teets, Jr., to E. Barnhart.

	V. M.	F. C.	Ash	S.	P.	B. T. U.	Dried at 212° F. B. T. U. Ash Free
Analysis:	30.03	64.03	5.94	1.02	.012	13,597	14,455

T. C.	H.	O.	Ratio H-O	N.
77.45	4.64	10.77	43.08	1.32

Gas:	CO_2	O_2	Ill.	CO	CH_4	H_2	N	C. P.	B. T. U.	Sp. Gr.
From Retort	9.2	.5	2.4	14.1	30.5	38.3	5.0	5.5	531	.540

Cu. Ft. gas per gross ton 10,000 — Candle Ft. per gross ton 55,000

Per cent. of coke: 73.00

Notes: This coal is a semi-coking coal. Coke has no structure.

Coal Exposure—No. 592 on Map II.

On the east side of Elk River, 1.8 miles westward from Diana; Sewell Coal; elevation, 1115′ B

	Ft.	In.
Sandstone, massive, cliff, Lower Guyandot	30	0
Coal, soft, good	1	0
Fire clay and dark slate	15	0
Sandstone, massive, Upper Raleigh (Sharon), to Elk River	15	0

Coal Exposure—No. 593 on Map II.

On the east side of Elk River, 1.8 miles westward from Diana; Sewell Coal; elevation, 1095′ B.

	Ft.	In.
Slate, black, cannelly, with coal streaks	1	0
Shale, dark	10	0
Concealed and sandstone to river	15	0

The two exposures noted above illustrate the thin character of the coal that seems to prevail for several miles along this portion of the Elk Valley.

At **Coal Prospect No. 594** on **Map II**, located on the east side of Elk River, 0.3 mile westward from Summit Station, the coal measured 1′ 8″, being medium-soft in character, and being overlain with 8 feet of the fossiliferous black Hartridge Shale, as detailed in the section for Summit, page 88, the elevation of the prospect being 1235′ B.

At **Coal Prospect No. 595 on Map II**, located on the east side of Elk River, 0.9 mile southwest of Tracy Switch, there was visible 0′ 8″ of coal coming 55 feet above the river, the full thickness being reported as 2′ 6″, as exhibited in the section for Tracy, page 90.

Coal Exposure—No. 596 on Map II.

Along the West Virginia Midland Railroad east of Elk River and 1.1 miles northwest of Skidmore Crossing; Sewell Coal; elevation, 1635′ B.

	Ft.	In.
Sandstone, massive, coarse, cliff, Upper Nuttall	30	0
Concealed, with dark slate	10	0
Sandstone, massive, coarse, great cliff, Lower Nuttall	55	0
Shale, sandy, dark, sandstone, shaly, and concealed in steep slope	124	0
Sandstone, massive, cliff, Guyandot	30	0
Coal, Sewell "B"	1	0
Shale, dark, sandy, with iron ore	10	0
Concealed and sandstone, massive, Lower Guyandot	29	0
Coal, Sewell (1635′ B.)	0	9
Fire clay shale to railroad grade	3	0

In the eastern end of Holly District, several openings have been made on the waters of Back Fork of Elk River. The following was reported by D. D. Teets, Jr.:

Holly Lumber Company Mine—No. 597 on Map II.

On Back Fork of Elk River, 1.1 miles southeast of the present location of Skelt Post-Office; **Sewell Coal**; elevation, 2125′ B.

			Ft.	In.
Sandstone, roof				
Coal, soft	1′	0″		
Bone	0	4½		
Coal, soft, columnar	1	6	2	10½
Fire clay shale, pavement				

A sample (No. 17) was collected from this opening by Mr. Teets, the composition of which is published under **Mine No. 597** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Croft Lumber Company Prospect—No. 598 on Map II.

On Back Fork of Elk River, 2 miles northeast of Waneta; **Sewell Coal**; elevation, 2700′ B.

			Ft.	In.
Shale, dark, sandy, **Hartridge**			20	0
Coal, soft	3′	10″		
Coal, bony	0	6	4	4
Fire clay shale, gray, with plant fossils			4	0

Holly Lumber Company Exposure—No. 599 on Map II.

On Sugar Creek, 1.5 miles eastward from the present location of Skelt Post-Office; **Sewell Coal**; elevation, 2130′ B.

			Ft.	In.
Dark shale and concealed			10	0
Coal	1′	0″		
Shale, dark	5	0		
Coal, soft	1	0	7	0
Fire clay shale and concealed			10	0
Sandstone, massive, to creek			10	0

At the following opening, now abandoned, the coal was once mined on a considerable scale by the Holly Lumber Company for use on its logging railroad in this region:

Holly Lumber Company Mine—No. 600 on Map II.

On Sugar Creek, 1.9 miles east of the present location of Skelt Post-Office; Sewell Coal; elevation, 2200′ B.

			Ft.	In.
1.	Slate, black			
2.	Coal, bony cannel	2′ 0″		
3.	Coal, cannel, good	0 9		
4.	Coal, soft	2 2	4	11
5.	Slate, pavement			

A sample (No. 216R) was collected from Nos. 3 and 4 of section, the composition of which is published under **Mine No. 600** in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 18) was collected by D. D. Teets, Jr., the composition of which is published under the same mine number (600) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The following mine lately opened on the Welsh Colony Tract supplies coal for the locomotives of the Ranwood Lumber Company on its narrow gauge line to Pickens:

Ranwood Lumber Company Mine—No. 601 on Map II.

On Sugar Creek, 1.4 miles eastward from the mouth of Mill Run and 5 miles south of Pickens; Sewell Coal; elevation, 2550′ B.

	Ft.	In.
Sandstone, shaly		
Shale, sandy, dark	1	0
Coal, medium-soft	3	6
Slate, pavement		

A sample (No. 213R) was collected from this place before the mine was driven into the hill, the composition of which is published under **Mine No. 601** in the Survey Table of Coal Analyses at the end of this Chapter.

Another sample, collected by the Lumber Company farther under the hill and analyzed in the laboratory of the Survey, shows the following:

	Per cent.
Moisture	0.96
Volatile Matter	31.81
Fixed Carbon	62.44
Ash	4.79
Total	100.00
Sulphur	0.56

A sample of the coal from this mine, collected by Mr. A. W. Ewing, Civil Engineer, of Pickens, W. Va., and analyzed by the Sandusky Cement Company, of Cleveland, Ohio, yielded the following results, as reported by Wm. B. Newberry, Assistant Manager:

	Per cent.
Volatile Matter	29.73
Fixed Carbon	64.20
Ash	6.07
Total	100.00
Iron oxide in ash	3.72
Iron oxide in coal	0.23
Color of ash	light buff

Sewell Coal, Holly District.

In Fork Lick District the Sewell Coal has been prospected and mined for local fuel at numerous points in the valleys of Elk and Gauley Rivers. Throughout most of this territory the coal is clean and free from slate partings and its analysis reveals a fuel of great excellence, very low in ash, sulphur, and phosphorus, and the frequency with which it has been prospected makes it certain that an immense amount of minable Sewell Coal exists above drainage in the two valleys.

Along Elk River the coal is high up against the mountains as the river has cut a channel several hundred feet deep into the red shales of the Mauch Chunk Series, so that inclines of considerable length will be required to handle it. The various openings noted on Elk and its tributaries in Fork Lick District are given in detail below.

The following opening, reported by D. D. Teets, Jr., is doubtfully classified as the Sewell Coal although its elevation would seem to be about 100 feet too high for the Sewell horizon in that particular locality where it was observed. It is possible that unfavorable barometric weather may have made the reported elevation somewhat inaccurate:

Coal Prospect—No. 602 on Map II.

On Lynch Run of Elk River, 1.3 miles southwest of Skidmore Crossing; Sewell? Coal; elevation, 2100′ B.

			Ft.	In.
Soil				
Coal, fair	1′	9″		
Shale, gray	0	8		
Coal	2	9	5	2

The John Skidmore Prospect (No. 603 on Map II), located on the north side of Elk River, 0.7 mile northwest of Skidmore Crossing, at an elevation of 1865′ B., had fallen shut, the coal being reported 4 feet thick by the owner.

The John Skidmore Prospect (No. 604 on Map II), located on the Right Branch of Kingfisher Creek, 1 mile southwest of Skidmore Crossing at an elevation of 2060′ B., had fallen shut, the coal being reported 5 feet thick by the owner.

The David Woods Farm Mine (No. 605 on Map II), located on the head of Kingfisher Creek, 1.8 miles southwest of Webster Springs, at an elevation of 2495′ B., had partly fallen shut, there being 3′ 2″ of clean, soft coal visible at the mouth of the entry, and a thickness of 3′ 6″ being reported at the working face.

The E. H. Morton Prospect (No. 606 on Map II), located at the extreme head of Kingfisher Creek, 1.7 miles southwest of Webster Springs, at an elevation of 2515′ B., had fallen shut, the coal being reported as 1′ 10″ thick.

William Payne Farm Mine—No. 607 on Map II.

On a branch of Kingfisher Creek, 1.1 miles southwest of Webster Springs; Sewell Coal; elevation, 2550′ B.

			Ft.	In.
Shale, sandy, Hartridge			5	0
Slate, black			0	6
Coal, soft	2′	1″		
Coal, hard	0	2		
Bone	0	1	2	4
Shale, gray, pavement				

Immediately north of Webster Springs along the road leading to Grassy Creek, a considerable amount of the coal

PLATE XXIX.—Typical Pottsville Topography on Gauley River, looking east from Gauley Mills.

has been mined for local domestic supply, the three following openings having been noted, all of which are now abandoned:

C. P. Dorr Heirs Mine—No. 608 on Map II.

On Elk River, 1.3 miles northward from Webster Springs; **Sewell Coal**; elevation, 2130′ B.

			Ft.	In.
Sandstone, massive				
Coal, soft, columnar	1′	4″		
Coal, harder	0	6	1	10
Shale, gray, with plant fossils				

C. P. Dorr Heirs Mine—No. 609 on Map II.

On Elk River, 1.2 miles northward from Webster Springs; **Sewell Coal**; elevation, 2155′ B.

			Ft.	In.
Sandstone, massive				
Coal, soft, columnar	1′	4″		
Coal, harder	0	5	1	9
Shale, gray, with plant fossils			2	0
Concealed to massive sandstone			13	0

C. P. Dorr Heirs Mine—No. 610 on Map II.

On Elk River, 0.8 mile northward from Webster Springs; **Sewell Coal**; elevation, 2195′ B.

			Ft.	In.
Sandstone, massive				
Coal, soft, columnar	1′	6″		
Coal, bony	0	1		
Coal, soft	1	4	2	11
Shale, gray, with plant fossils				

On Back Fork of Elk River almost immediately northeast of Webster Springs, the coal has been opened and mined on a considerable scale by E. H. Gillespie for the local trade at Webster Springs, the loaded coal cars being let down the steep mountainside by a gravity track. These workings are not now in operation but the four following measurements were made:

E. H. Gillespie Mine—No. 611 on Map II.

On Back Fork of Elk River, 0.8 mile northeast of Webster Springs; **Sewell Coal**; elevation, 2260′ B.

			Ft.	In.
Sandstone, massive				
Coal, soft, columnar	1′	4½″		
Slate, black	0	0½		
Coal, blocky	0	7	2	0
Shale, gray, with plant fossils				

E. H. Gillespie Mine—No. 612 on Map II.

On Back Fork of Elk River, 0.8 mile northeast of Webster Springs; **Sewell Coal**; elevation, 2260′ B.

			Ft.	In.
1. Sandstone, massive				
2. **Coal**, soft, columnar	1′	4 ″		
3. Slate, black	0	0½		
4. **Coal**, harder	0	7½	2	0
5. Shale, gray				

A sample (No. 175R) was collected from Nos. 2 and 4 of section the composition of which is published under **Mine No. 612** in the Survey Table of Coal Analyses at the end of this Chapter.

E. H. Gillespie Mine—No. 613 on Map II.

On Back Fork of Elk River, 0.8 mile northeast of Webster Springs; **Sewell Coal**; elevation, 2265′ B.

			Ft.	In.
Sandstone, massive				
Coal, soft, columnar	1′	4″		
Coal, hard, blocky	0	6	1	10
Shale, gray, with plant fossils				

E. H. Gillespie Mine—No. 614 on Map II.

On Back Fork of Elk River, 0.8 mile northeast of Webster Springs; **Sewell Coal**; elevation, 2265′ B.

			Ft.	In.
Sandstone, massive				
Coal, soft, columnar	1′	4″		
Coal, hard, blocky	0	6	1	10
Shale, gray, with plant fossils			4	0

The **George Mollohan Prospect (No. 615 on Map II)**, located on Mill Run of Back Fork of Elk River, 1.5 miles

northeast of Webster Springs, at an elevation of 2200′ B., had fallen shut, the thickness of the coal not being learned.

Henry Miller Farm Mine—No. 616 on Map II.

On the south side of Back Fork of Elk River, 2.1 miles eastward from Webster Springs; **Sewell Coal**; elevation, 2385′ B.

			Ft.	In.
Shale, dark, sandy, **Hartridge**			20	0
Coal, slaty	0′	6″		
Coal, soft, columnar	2	10	3	4
Slate, pavement				

A sample (No. 2) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 616** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Bailey Fisher Farm Mine—No. 617 on Map II.

On Drybed Run of Back Fork of Elk River, 2.3 miles northeast of Webster Springs; **Sewell Coal**; elevation, 2210′ B.

			Ft.	In.
1. Slate, black, reported			4	0
2. **Coal**, hard	0′	6″		
3. **Coal**, soft	2	8	3	2
4. Shale, gray, with plant fossils				

A sample (No. 172R) was collected from Nos. 2 and 3 of section, the composition of which is published under **Mine No. 617** in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 7) was collected by D. D. Teets, Jr., the composition of which is published under the same mine number (617) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter. Coal from this mine furnishes the principal source of supply for domestic use at Webster Springs, two or three miners being employed, the daily output of 150 to 200 bushels being wagoned into the Springs.

The **Miller Heirs Farm Mine (No. 618 on Map II)**, located on Drybed Run of Back Fork of Elk River, 2.4 miles northeast of Webster Springs, at an elevation of 2195′ B., had filled

with water and could not be measured, the coal having once been mined there by a short slope.

The **Marion Miller Farm Mine (No. 619 on Map II)**, located on the east side of Drybed Run of Back Fork of Elk River, 2.4 miles northeast of Webster Springs, at an elevation of 2205′ B., had fallen shut and could not be measured, George A. Hechmer being authority for the statement that the coal measured 4 to 5 feet, at the working face.

A sample (No. 1) was collected from this opening, evidently before it had fallen shut, by D. D. Teets, Jr., the composition of which is published under **Mine No. 619** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The **Alexander Hamrick Farm Mine (No. 620 on Map II)**, located on the south side of Back Fork of Elk River, 0.5 mile northeast of Ralph, at an elevation of 2370′ B., had fallen shut, its thickness being reported as 3′ 10″ by Arlan Hamrick.

Holly-Elk Coal Company Prospect—No. 621 on Map II.

On the south side of Back Fork of Elk River, 0.7 mile northeast of Ralph; **Sewell Coal**; elevation, 2365′ B.

	Ft.	In.
Shale, dark		
Coal, soft	4	5
Slate, pavement		

At this point the company has cleared and partly graded an incline track to a contemplated siding on the Back Fork Branch of the West Virginia Midland Railroad, but the work has been temporarily abandoned.

Holly-Elk Coal Company Farm Mine—No. 622 on Map II.

On the south side of Back Fork of Elk River, 0.8 mile northeast of Ralph; **Sewell Coal**; elevation, 2365′ B.

	Ft.	In.
Shale, dark, **Hartridge**	10	0
Coal, soft	5	0
Shale, pavement		

A sample (No. 237R) was collected from this opening, the composition of which is published under **Mine No. 622** in the Survey Table of Coal Analyses at the end of this Chapter.

Marion Miller Prospect—No. 623 on Map II.

On the north side of Back Fork of Elk River, 1.1 miles southwest of Breece; **Sewell Coal**; elevation, 2200′ B.

	Ft.	In.
Shale, dark, ferruginous, **Hartridge**	10	0
Coal, soft	4	3
Shale, pavement		

Camden-Johnson Prospect—No. 624 on Map II.

On Laurel Run of Back Fork of Elk River, 0.2 mile northwest of Breece; **Sewell Coal**; elevation, 2060′ B.

	Ft.	In.
Sandstone, shaly		
Shale, dark, with **Naiadites fossils, Hartridge**	5	0
Coal	1	0
Shale, pavement		

The **Camden-Johnson Prospect (No. 625 on Map II)**, located on the west side of Back Fork of Elk River, 1.1 miles northeastward from Breece, at an elevation of 1915′ B., had fallen shut, the coal being reported 1 foot thick, and coming 25 feet above an opening in the Welch Coal.

Coal Prospect No. 626 on Map II, located on the west side of Back Fork of Elk River, 1.9 miles northeast of Breece, at an elevation of 1960′ B., had fallen shut, its thickness not being learned.

John Hostetter Prospect—No. 627 on Map II.

On the east side of Back Fork or Elk River, 0.8 mile south of the mouth of Sugar Creek and 1.7 miles southward from the present location of Skelt Post-Office; **Sewell Coal**; elevation, 1965′ B.

	Ft.	In.
Shale, dark, **Hartridge**		
Coal, medium-soft	2	0
Slate, dark, pavement		

Holly Lumber Company Exposure—No. 628 on Map II.

On Back Fork of Elk River just above the mouth of Middle Run and 0.8 mile southeast of the present location of Skelt Post-Office; **Sewell Coal**; elevation, 1960′ B.

	Ft.	In.
Sandstone, massive, **Lower Guyandot**		
Coal	1	6
Sandstone, in river		

Holly Lumber Company Exposure—No. 629 on Map II.

On Back Fork of Elk River, just below Point Mountain Run and 0.6 mile southeast of the present location of Skelt Post-Office; **Sewell Coal**; elevation, 1935′ B.

	Ft.	In.
Sandstone, massive, great cliffs, **Lower Guyandot**	40	0
Coal	1	4
Shale, sandy and ferriferous, to railroad grade	10	0
Concealed to river	5	0

The **Holly Lumber Company Prospect** (No. 630 on Map II), located on the south side of Back Fork of Elk River, 1.4 miles southeast of the present location of Skelt Post-Office, at an elevation of 2145′ B., had fallen shut and its thickness was not learned.

Holly Lumber Company Exposure—No. 631 on Map II.

In a ravine on the south side of Back Fork of Elk River, 1.5 miles southeast of the present location of Skelt Post-Office; **Sewell Coal**; elevation, 2145′ B.

	Ft.	In.
Sandstone, massive		
Shale, dark, sandy, **Hartridge**	2	0
Coal, soft	3	8
Shale, pavement		

East of the above exposure no other openings in the Sewell Coal were noted along the south side of Back Fork in Fork Lick District, Webster, as the region is entirely wooded and apparently has not been prospected. Two openings (Nos. 597 and 598) located on the north side of Back Fork in Holly District, have been previously noted, page 445, and above the Webster-Randolph County Line several openings have been made, as previously described by the writer in the Barbour, Upshur and Western Portion of.

Randolph County Report of the Survey, revealing a fine body of good coal.

On main Elk River and its tributaries above Webster Springs, where the Sewell Coal lies high up in the mountains, numerous prospects have been made, the following having been noted:

The **E. H. Morton Prospect (No. 632 on Map II)**, located on the south side of Elk River, 0.9 mile southward from Webster Springs, at an elevation of 2500′ B., had fallen shut, its thickness being reported as 4′ 0″.

Reuben Weese Farm Mine—No. 633 on Map II.

On the south side of Elk River, 1.5 miles southeast of Webster Springs; **Sewell Coal**; elevation, 2515′ B.

	Ft.	In.
Sandstone, massive		
Shale, dark, sandy, **Hartridge**	3	0
Coal, soft	4	0
Shale, gray, with plant roots		

A sample (No. 4) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 633** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Farm Mine (Nathan Hamrick Opening)—No. 634 on Map II.

On the south side of Elk River, 1.7 miles southeast of Webster Springs; **Sewell Coal**; elevation, 2510′ B.

	Ft.	In.
Sandstone, massive		
Shale, dark, sandy, **Hartridge**	3	0
Coal, soft	3	9
Slate, pavement		

James Elbon Farm Mine—No. 635 on Map II.

On the south side of Elk River, 1.9 miles southeast of Webster Springs; **Sewell Coal**; elevation, 2460′ B.

	Ft.	In.
Slate, dark, and **coal blossom**		
Sandstone, shaly	2	0
Shale, dark, **Hartridge**	1	0
Coal, soft	3	6
Slate, pavement		

The **James Elbon Prospect (No. 636 on Map II)**, located on the south side of Elk River, 2 miles southeast of Webster Springs, at an elevation of 2465′ B., had fallen shut, its thickness not being learned.

A. W. Cutlip Farm Mine—No. 637 on Map II.

On the head of Dyer Run of Elk River, 2.6 miles southeast of Webster Springs; **Sewell Coal**; elevation, 2525′ B.

			Ft.	In.
Shale, dark, sandy				
Coal, soft	0′	9″		
Slate, black	0	2		
Coal, soft, visible	2	7	3	6
Concealed by water				

Pardee & Curtin Lumber Company Prospect (Dyer Run Opening)—No. 638 on Map II.

On the south side of Elk River east of Dyer Run and 2.8 miles southeast of Webster Springs; **Sewell Coal**; elevation, 2505′ B.

			Ft.	In.
1. Slate, black				
2. **Coal**, soft	0′	5 ″		
3. Slate, dark	0	0¼		
4. **Coal**, soft, columnar	2	6¾		
5. **Coal**, medium-hard	0	4		
6. **Coal**, soft, columnar	1	8	5	0
7. Slate, pavement				

A sample (No. 178R) was collected from Nos. 2, 4, 5 and 6 of section, the composition of which is published under **Mine No. 638** in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 51) was collected by D. D. Teets, Jr., the composition of which is published under the same mine number (638) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

P. B. Weatherhead Farm Mine—No. 639 on Map II.

On the north side of Elk River, 1 mile southwest of Ralph; **Sewell Coal**; elevation, 2355′ B.

			Ft.	In.
Shale, dark				
Coal, slaty	0′	5″		
Coal, soft, columnar	3	11	4	4
Shale and concealed, to Welch Coal			22	0

A sample (No. 10) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 639** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Prospect (Levi Gregory Opening)—No. 640 on Map II.

On the south side of Elk River, 1.4 miles southeast of Ralph; **Sewell Coal**; elevation, 2520′ B.

			Ft.	In.
Shale, sandy, **Hartridge**			10	0
Coal, slaty	0′	8″		
Coal, soft	1	8	2	4
Shale, gray, with plant roots				

Jonathan Hamrick Farm Mine—No. 641 on Map II.

On the north side of Elk River, 0.7 mile northeast of Ralph; **Sewell Coal**; elevation, 2375′ B.

	Ft.	In.
Slate, dark		
Coal, medium-soft	3	10
Slate, pavement		

A sample (No. 3) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 641** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Prospect (Thomas Hamrick Opening)—No. 642 on Map II.

On a branch of Mill Run of Elk River, 2 miles eastward from Ralph; **Sewell Coal**; elevation, 2575′ B.

			Ft.	In.
Sandstone			5	0
Shale, dark, **Hartridge**			1	6
Coal, slaty	0′	6″		
Shale, gray	0	6		
Coal, medium-soft	2	5	3	5
Slate, pavement				

H. W. Cogar Farm Mine—No. 643 on Map II.

On Mill Run of Elk River, 2.2 miles southeast of Ralph; Sewell Coal; elevation, 2615′ B.

	Ft.	In.
Slate, dark		
Coal, soft	5	0
Sandstone, massive		

A sample (No. 196R) was collected from this opening, the composition of which is published under **Mine No. 643** in the Survey Table of Coal Analyses at the end of this Chapter.

H. W. Cogar Farm Mine—644 on Map II.

On Mill Run of Elk River, 2.2 miles southeast of Ralph; Sewell Coal; elevation, 2600′ B.

	Ft.	In.
Slate, black		
Coal, 4′ 5″ to	4	8
Slate, pavement		

George Gregory Farm Mine—No. 645 on Map II.

On Mill Run of Elk River, 2.3 miles southeast of Ralph; Sewell Coal; elevation, 2590′ B.

		Ft.	In.
Slate, dark			
Coal, soft	3′ 0″		
Coal, medium-hard	0 6		
Coal, soft	0 11	4	5
Slate, pavement			

George Gregory Farm Mine—No. 646 on Map II.

On Mill Run of Elk River, 2.6 miles southeast of Ralph; Sewell Coal; elevation, 2600′ B.

	Ft.	In.
Slate, dark		
Coal, soft	3	11
Shale, gray, pavement		

A sample (No. 5) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 646** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

West Virginia Pulp & Paper Company Farm Mine—No. 647 on Map II.

On Mill Run of Elk River. 2.5 miles southeast of Ralph; **Sewell Coal**; elevation, 2600′ B.

	Ft.	In.
Slate, dark		
Coal, soft	4	3
Slate, pavement		

Sampson Hamrick Farm Mine—No. 648 on Map II.

On the north side of Elk River, 0.3 mile northwest of Bernardstown; **Sewell Coal**; elevation, 2345′ B.

	Ft.	In.
Shale, black, with **Lingula** fossils, **Hartridge**	15	0
Coal, fallen shut, reported	2	4

The **Vincent Hamrick Farm Mine** (No. 649 on Map II), located on Steps Run of Elk River, 0.6 mile northeast of Bernardstown, at an elevation of 2510′ B., measured 2′ 10″ of clean, soft coal, as detailed in the section for Bernardstown, page 99.

Pardee & Curtin Lumber Company Farm Mine (Henry Dodrill Opening)—No. 650 on Map II.

On the south side of Elk River, 0.7 mile westward from Bergoo village; **Sewell Coal**; elevation, 2735′ B.

	Ft.	In.
Sandstone, massive		
Coal, soft	2	6
Shale, sandy, pavement		

A sample (No. 179R) was collected from this opening, the composition of which is published under Mine No. 650 in the Survey Table of Coal Analyses at the end of this Chapter.

At **Coal Exposure No. 651 on Map II**, located on Leatherwood Creek, 1.1 miles southeast of Bergoo village, the coal is visible along the road leading to Redoak Knob, having a thickness of 2 feet or more and an elevation of 2755′ B., and coming 40 feet above the Welch Coal which has been mined along the same road, the relationship of the two seams being exhibited in the section for Bergoo, page 102.

Pardee & Curtin Lumber Company Prospect—No. 652 on Map II.

Between the forks of Leatherwood Creek, 3.2 miles southeast of Bergoo village; Sewell Coal; elevation, 2980′ B.

	Ft.	In.
Slate, black		
Coal, medium-soft	4	3
Slate, pavement		

A sample (No. 197R) was collected from this opening, composition of which is published under **Mine No. 652** in the Survey Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Farm Mine (Elza Hamrick Opening)—No. 653 on Map II.

On the north side of Bergoo Creek, 2.5 miles northeast of Bergoo village; Sewell Coal; elevation, 2790′ B.

			Ft.	In.
1. Slate, black, cannel				
2. Coal, cannel	3′	0″		
3. Coal, soft	3	0	6	0
4. Slate, pavement, and concealed to Welch Coal			16	0

A sample (No. 200R) was collected from Nos. 2 and 3 of section, the composition of which is published under **Mine No. 653** in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 15) was collected from the same portions of the seam by D. D. Teets, Jr., the composition of which is published under the same mine number (653) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter. The large amount of cannel found in the seam at this point is unusual and appears to be purely a local occurrence.

Pardee & Curtin Lumber Company Farm Mine (Robert Rose Opening)—No. 654 on Map II.

On a branch of Bergoo Creek, 4 miles southeast of Bergoo village; Sewell Coal; elevation, 3150′ B.

			Ft.	In.
1. Shale, dark, sandy, Hartridge			10	0
2. Coal, soft	0′	5″		
3. Slate, dark	0	5		
4. Coal, soft	2	7	3	5
5. Slate, pavement				

A sample (No. 199R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 654** in the Survey Table of Coal Analyses at the end of this Chapter.

Another sample (No. 12) was collected from this opening by D. D. Teets, Jr., the composition of which is published under the same mine number (654) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The following opening, where the coal has been mined by stripping, is reported by D. D. Teets, Jr., and seems to represent the Sewell Coal although the elevation seems slightly too low for this coal in the particular locality where it was noted:

W. H. Green Farm Mine—No. 655 on Map II.

On a branch of Bergoo Creek, 5.1 miles eastward from Bergoo village; **Sewell Coal**; elevation, 3140′ B.

	Ft.	In.
Slate		
Coal, soft	3	0
Concealed		

A sample (No. 13) was collected from this opening by Mr. Teets, the composition of which is published under **Mine No. 655** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Prospect (Paris Green Opening)—No. 656 on Map II.

On a branch of Bergoo Creek, 5.2 miles eastward from Bergoo village; **Sewell Coal**; elevation, 3175′ B.

		Ft.	In.
1. Slate, dark			
2. **Coal**, soft	2′ 0½″		
3. Slate, dark	0 6½		
4. **Coal**, soft	3 0	5	7
5. Slate, pavement			

A sample (No. 231R) was collected from Nos. 2 and 4 of section, the composition of which, as analyzed on a dry basis in the private laboratory of the West Virginia Pulp & Paper Company, at Luke, Md., is as follows:

	Per cent.
Volatile combustible matter	29.19
Fixed Carbon	62.64
Ash	8.17
Total	100.00
Sulphur	1.16
B. T. U.	13,967

Pardee & Curtin Lumber Company Prospect—No. 657 on Map II.

On the head of Little Run of Elk River, 1.4 miles southwest of Waneta; **Sewell Coal**; elevation, 2820′ B.

	Ft.	In.
Shale, dark		
Coal, lenticular, 0′ 0″ to	0	6
Shale, dark, with ferriferous limestone nodules and marine? fossils, **Hartridge**	5	0
Coal, fallen shut, reported	3	6

Pardee & Curtin Lumber Company Prospect (Moore Hamrick Opening)—No. 658 on Map II.

On Big Run of Elk River, 0.2 mile southward from Waneta; **Sewell Coal**; elevation, 2895′ B.

	Ft.	In.
Sandstone, massive		
Concealed	20	0
Shale, dark, **Hartridge**	2	0
Coal, medium-soft	2	5
Slate, pavement		

Pardee & Curtin Lumber Company Prospect (A. H. McAtee Opening)—No. 659 on Map II.

On Big Run of Elk River, 0.5 mile southeast of Waneta; **Sewell Coal**; elevation, 3000′ B.

	Ft.	In.
Sandstone, massive		
Slate, dark	0	6
Coal, medium-soft	2	9
Sandstone		

The **Jacob Fisher Prospect (Lee A. Hamrick Opening)—No. 660 on Map II**, located on Big Run of Elk River 0.9 mile southeast of Waneta, at an elevation of 3105′ B., measured 4′ 0″ of clean, blocky coal, as detailed in the section for Waneta, page 100.

A sample (No. 162R) was collected from this opening, the composition of which is published under Mine No. 660 in the Survey Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Farm Mine (Walter Hamrick Opening)—No. 661 on Map II.

On the north side of Elk River, 1.1 miles west of Samp; Sewell Coal; elevation, 3195′ B.

	Ft.	In.
Sandstone, massive		
Coal, soft	4	0
Sandstone, massive	15	0

On the Gauley River, which has a general topographic level of nearly 800 feet above that of Elk, the Sewell Coal rises above drainage near the Glade-Fork Lick District Line one mile and a half southwest of Bolair, and east of that point has been prospected in several localities, showing much the same character and thickness as the openings along Elk.

The **William Mustoe Prospect (No. 662 on Map II)**, located on the north side of Gauley, 0.3 mile west of Bolair, at an elevation of 2475′ B., had fallen shut, but was reported 1′ 11″ thick by D. D. Teets, Jr., who reopened the prospect subsequent to the visit of the writer.

At the **Zebulon Bee Heirs Farm Mine (No. 663 on Map II)**, located on the south side of Gauley, 0.6 mile southeast of Bolair, at an elevation of 2538′ B., the coal was once mined by stripping but had fallen shut, its thickness being reported as 3 feet, and its position being 28 feet above the Welch Coal which has been opened in the same hillside, the relationship of the two seams being exhibited in the section for Bolair, page 105.

The **Arthur Bankhead Prospect (No. 664 on Map II)**, located on Sandy Run, 1.1 miles northeast of Bolair, at an elevation of 2620′ B., coming 30 feet above the Welch, had fallen shut, its thickness not being learned.

The **John W. Payne Prospect (No. 665 on Map II)**, located on Sandy Run, 1.3 miles northeast of Bolair, at an elevation of 2608′ B., had fallen shut, its thickness being re-

ported by the owner as 1′ 10″, and its position being 28 feet above the base of the Welch Coal by hand-level measurement.

Pardee & Curtin Lumber Company Prospect—No. 666 on Map II.

On the north side of Gauley River, 0.7 mile northwest of the mouth of Beaver Run and 1.7 miles eastward from Bolair; **Sewell Coal**; elevation, 2610′ B.

	Ft.	In.
Slate, dark	0	2
Coal, soft	1	7
Slate, dark, hard, with plant roots		

Pardee & Curtin Lumber Company Farm Mine—No. 667 on Map II.

On a branch of Beaver Run of Gauley River, 0.8 mile northeast of the mouth of Beaver and 2.9 miles eastward from Bolair; **Sewell Coal**; elevation, 2535′ B.

	Ft.	In.
Shale, dark, **Hartridge**	5	0
Coal, partly concealed by water, estimated 3′ 6″ to	4	0

W. P. Miller Heirs Farm Mine—No. 668 on Map II.

On the south side of Gauley River, 0.4 mile southeast of the mouth of Miller Mill Run and 2.5 miles southeast of Bolair; **Sewell Coal**; elevation, 2625′ B.

	Ft.	In.
Slate, dark		
Coal, soft	3	3
Slate, pavement		

J. O. Miller Farm Mine—No. 669 on Map II.

On the north side of Gauley River, 0.5 mile west of the mouth of Laurel Creek, and 2.9 miles southeastward from Bolair; **Sewell Coal**; elevation, 2505′ B.

		Ft.	In.
Coal, soft, reported	2′ 0″		
Coal, hard, reported	3 0	5	0

The above opening had fallen shut, the section being reported by a resident.

PLATE XXX (a).—Gauley Mill of Cherry River Boom and Lumber Company at Gauley Mills.

PLATE XXX (b).—Lumber Yard at same plant, with Gauley River at left middle; Topography of Pottsville Series.

Pardee & Curtin Lumber Company Prospect—No. 670 on Map II.

On the north side of Gauley River, 0.4 mile northwest of the mouth of Laurel Creek and 3 miles eastward from Bolair; **Sewell Coal**; elevation, 2530′ B.

	Ft.	In.
Shale, black, with **Naiadites** fossils, **Hartridge**	3	0
Coal, soft	3	10
Slate, pavement		

A sample (No. 50) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 670** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The **A. W. Cutlip Prospect (No. 671 on Map II)**, located on Laurel Creek, 0.8 mile northeast of the mouth of the creek and 3.5 miles eastward from Bolair, at an elevation of 2540′ B., had fallen shut, the thickness of the coal not being learned.

The **Pardee & Curtin Lumber Company Prospect (Isaac Cogar Opening—No. 672 on Map II)**, located on the head of Laurel Creek, 1.5 miles from its mouth and 4.7 miles eastward from Bolair, at an elevation of 2635′ B., had fallen shut, its thickness being reported as 1′ 8″.

The **Cherry River Boom and Lumber Company Prospect (James M. Cogar Opening—No. 673 on Map II)**, located on the south side of Gauley River, 0.4 mile southwest of the mouth of Laurel Creek and 3.3 miles southeast of Bolair, at an elevation of 2585′ B., had fallen shut, its thickness being reported by Mr. Cogar as 3′ 8″.

James M. Cogar Farm Mine—No. 674 on Map II.

On the north side of Gauley River, 0.6 mile southeast of the mouth of Laurel Creek, and 3.9 miles eastward from Bolair; **Sewell Coal**; elevation, 2565′ B.

	Ft	In.
Shale, dark, with **Lingula** fossils, **Hartridge**	5	0
Coal, soft	3	2
Slate, pavement		

Cherry River Boom and Lumber Company Prospect (Heaston Dodrill Opening)—No. 675 on Map II.

On the south side of Gauley River, 0.3 mile southeast of the mouth of Turkey Creek; Sewell Coal; elevation, 2516′ B.

	Ft.	In.
Slate		
Coal, soft	3	6
Slate and sandstone to Welch Coal	2	6

Cherry River Boom and Lumber Company Prospect (McFall Brothers Opening)—No. 676 on Map II.

On Turkey Creek of Gauley, 1.8 miles southeast of its mouth; **Sewell Coal**; elevation, 2530′ B.

	Ft.	In.
Slate, black		
Coal, soft	3	6
Slate, pavement, and concealed to creek	2	0

Pardee & Curtin Lumber Company Prospect—No. 677 on Map II.

On Hughes Run of Gauley, 1.2 miles north of its mouth; **Sewell Coal**; elevation, 2665′ B.

	Ft.	In.
Soil		
Coal, medium-soft	4	0
Slate, pavement		

The Pardee & Curtin Lumber Company Prospect (Bernard Baughman Opening—No. 678 on Map II), located on Hughes Run of Gauley, 0.9 mile northeast of the mouth of the run, at an elevation of 2660′ B., had fallen shut, no report having been obtained as to the thickness of the coal.

Pardee & Curtin Lumber Company Prospect (Bernard Baughman Opening)—No. 679 on Map II.

On Baughman Run of Gauley, 0.7 mile northeast of its mouth; **Sewell Coal**; elevation, 2670′ B.

		Ft.	In.
Slate, dark			
Coal, slaty	0′ 11″		
Slate, gray	0 2		
Coal	3 0	4	1
Slate, pavement			

The above section was measured at the pit mouth, the entry being partly filled with water and mud. According to Mr. Baughman the coal measured 5′ 0″ at the face.

Cherry River Boom and Lumber Company Prospect (William Baker Opening)—No. 680 on Map II.

On the south side of Gauley River, 0.2 mile southwest of the mouth of Ash Bee Tree Hollow; **Sewell Coal**; elevation, 2730′ B.

	Ft.	In.
Slate		
Coal, soft	3	10
Slate, pavement		

Cherry River Boom and Lumber Company Prospect (Napoleon Barbe Opening)—No. 681 on Map II.

On the south side of Gauley River, 0.3 mile southeast of the mouth of Jim Spring Run; **Sewell Coal**; elevation, 2735′ B.

	Ft.	In.
Slate, black		
Coal, soft	4	3
Slate, pavement		

Pardee & Curtin Lumber Company Prospect (Frazier Opening)—No. 682 on Map II.

On the north side of Gauley River, 0.4 mile northeast of the mouth of Jim Spring Run; **Sewell Coal**; elevation, 2770′ B.

	Ft.	In.
Slate, black		
Coal, soft	4	4
Slate, pavement		

A sample (No. 205R) was collected from this opening, the composition of which is published under **Mine No. 682** in the Survey Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Prospect (Brown Opening)—No. 683 on Map II.

On Williams Camp Run of Gauley River, 0.5 mile northeast of its mouth; **Sewell Coal**; elevation, 2765′ B.

	Ft.	In.
Slate, black		
Coal, soft	4	6
Slate, pavement		

Pardee & Curtin Lumber Company Prospect (Miletus L. Baughman Opening)—No. 684 on Map II.

Between the forks of Johnson Hollow of Gauley River, 0.4 mile north of its mouth; Sewell Coal; elevation, 2870′ B.

	Ft.	In.
Slate, black		
Coal, soft	3	5
Slate, pavement		

At the above opening the coal and roof slate were somewhat broken and the measurement may not represent the full thickness of the coal.

At the **Pardee & Curtin Lumber Company Prospect (No. 685 on Map II)**, located on the north side of Gauley River, 0.4 mile northward from the Three Forks of Gauley, at an elevation of 3150′ B., 1 foot of coal was visible, there being considerable doubt as to whether the full thickness of the seam was exposed.

Sewell Coal, Glade District.

In Glade District the Sewell Coal crops over a considerable portion of the drainage of Williams and Cranberry Rivers, but has been prospected little except on Williams between Dyer and the Three Forks of Williams. Over the remainder of this vast acreage, covered almost entirely by virgin or cut-over forest, the coal has been opened at only a few points and extensive prospecting will be necessary to establish fully the value of its coal resources. Its geographic position would indicate that the Sewell Coal should be found in the major portion of this land.

On the Williams River the Sewell rises above drainage in the vicinity of Dyer, and remains above all the way to the Pocahontas County Line, the following prospects having been observed:

The **G. R. Hickman Farm Mine (No. 686 on Map II)**, located on the north side of Williams River, immediately north of Dyer, at an elevation of 2235′ B., had fallen shut, the thickness of the coal being reported by George M. Dyer as 2′ 8″.

G. R. Hickman Farm Mine—No. 687 on Map II.

On the north side of Williams River, 0.2 mile northeast of Dyer; **Sewell Coal**; elevation, 2245′ B.

	Ft.	In.
Sandstone, shaly	5	0
Coal, soft, columnar	2	2
Slate, pavement		

Cherry River Boom and Lumber Company Prospect—No. 688 on Map II.

On the south side of Williams River, 0.5 mile southeast of Dyer; **Sewell Coal**; elevation, 2340′ B.

			Ft.	In.
1. Shale, dark, sandy, **Hartridge**			4	0
2. **Coal**, slaty	0′	3″		
3. **Coal**, soft, columnar	2	0	2	3
4. Slate, pavement				

A sample (No. 194R) was collected from No. 3 of section, the composition of which is published under **Mine No. 688** in the Survey Table of Coal Analyses at the end of this Chapter.

The **Arthur Brooks Prospect (No. 689 on Map II)**, located on the north side of Williams River, 0.8 mile eastward from Dyer, at an elevation of 2510′ B., had fallen shut, the coal being reported as a thin seam.

The **Frank Dunlap Prospect (No. 690 on Map II)**, located on the north side of Williams River, 1.3 miles eastward from Dyer, at an elevation of 2690′ B., had fallen shut, its thickness not being learned.

At the **Cherry River Boom and Lumber Company Prospect (Lewis Cleavenger Opening—No. 691 on Map II)**, located on the south side of Williams River, 1.6 miles southeast of Dyer, at an elevation of 2695′ B., there was 2′ 6″ of coal visible, but it is possible that this measurement did not represent the full thickness as the entry had not been driven to a solid roof.

Cherry River Boom and Lumber Company Prospect—No. 692 on Map II.

On the south side of Williams River, 0.3 mile westward from the mouth of Johnson Run and 2.1 miles northwest of the Three Forks of Williams; Sewell Coal; elevation, 2610′ B.

	Ft.	In.
Sandstone, massive		
Coal, soft	2	2
Fire clay, shale		

Cherry River Boom and Lumber Company Prospect (John Leslie Opening)—No. 693 on Map II.

On Johnson Run of Williams River, 2.1 miles west of the Three Forks of Williams; Sewell Coal; elevation, 2620′ B.

	Ft.	In.
Slate, dark		
Coal, soft	3	1
Slate, pavement		

A sample (No. 206R) was collected from this opening, the composition of which is published under Mine No. 693 in the Survey Table of Coal Analyses at the end of this Chapter.

Cherry River Boom and Lumber Company Prospect (John Leslie Opening)—No. 694 on Map II.

On the north side of Williams River, west of the mouth of Whiteoak Fork and 1.5 miles northwest of the Three Forks of Williams; Sewell Coal; elevation, 2510′ B.

		Ft.	In.
Shale, dark, with fossils, Hartridge		5	0
Coal, slaty	0′ 6″		
Coal, good, soft	2 0	2	6
Slate, pavement			

Cherry River Boom and Lumber Company Prospect (John Leslie Opening)—No. 695 on Map II.

On the north side of Williams River, east of Whiteoak Fork and 1.1 miles northwest of the Three Forks of Williams; Sewell Coal; elevation, 2555′ B.

		Ft.	In.
Shale, dark, with Lingulae and Naiadites, Hartridge			
Coal, soft	1′ 10″		
Slate	4 0		
Coal soft	1 3	7	1

Cherry River Boom and Lumber Company Prospect (J. C. Mullens Prospect)—No. 696 on Map II.

On the south side of Williams River, 0.4 mile northeast of the Three Forks of Williams; Sewell Coal; elevation, 2740′ B.

			Ft.	In.
Shale, black, with Lingulae, Hartridge				
Coal	0′	8″		
Slate, gray	0	6		
Coal, soft	1	7	2	9
Slate, pavement				

Cherry River Boom and Lumber Company Prospect—No. 697 on Map II.

On the north side of Williams River, 0.7 mile northeast of Three Forks of Williams; Sewell Coal; elevation, 2720′ B.

	Ft.	In.
Slate, dark		
Coal, soft	1	10
Slate, pavement		

A sample (No. 208R) was collected from this opening the composition of which is published under Mine No. 697 in the Survey Table of Coal Analyses at the end of this Chapter.

Cherry River Boom and Lumber Company Prospect—No. 698 on Map II.

On Mill Run, 2 miles northeast of the Three Forks of Williams River; Sewell Coal; elevation, 2745′ B.

	Ft.	In.
Slate		
Coal, bony	1	5
Slate, pavement		

The following opening is reported to the Survey by Hon. Elmer Hough, of Wellsburg, West Virginia, who discovered it during a private investigation along Williams River in the summer of 1919. Inasmuch as it is situated in a region where little prospecting has been done, it constitutes an important contribution:

Cherry River Boom and Lumber Company Prospect—No. 698A on Map II.

On Slabcamp Branch of Williams River, 5.4 miles northeast of the Three Forks and 1.1 miles northwest of the Webster-Pocahontas line; **Sewell Coal**; elevation, 2910′ B.?

			Ft.	In.
Black, slate, roof				
Coal, cannel	0′	4″		
Coal, medium-hard, columnar	1	8		
Coal, soft	3	0		
Coal, bony	0	2		
Coal, soft	0	5	5	7
Slate, pavement, and concealed to top of Princeton Conglomerate			170	0

Mr. Hough's determination of the interval from the coal to the top of the conglomerate, which is unmistakable in that region, seems to make the correlation of the prospect with the Sewell Coal reasonably certain, since he has the proper interval above this great ledge. The structure contours on Map II, however, would indicate that the Sewell belongs about 100 feet higher in the mountain, and it seems probable that the elevation as recorded may be somewhat in error.

On the Cranberry River the following opening was noted a short distance west of the Webster line:

Cherry River Boom and Lumber Company Prospect—No. 699 on Map II.

In Beaver District, Nicholas County, on the south side of Cranberry River, 5 miles east of Cranberry Station and 1.3 miles from the Webster line; **Sewell Coal**; elevation, 2325′ B.

			Ft.	In.
Slate, dark				
Coal, soft	0′	10″		
Slate, black, bony	1	2		
Coal, soft	1	1	3	1
Slate, pavement				

Sewell Coal, Mingo District, Randolph County.

In that portion of Mingo District, Randolph County, lying south of Valley Fork of Elk River, and embraced in this Report, the Sewell Coal lies high up against the moun-

tains and has been prospected but little, most of the land being virgin forest. The two following prospects were noted:

West Virginia Pulp & Paper Company Prospect—No. 700 on Map II.

On the south side of Elk River, 1 mile southeast of the Whitaker Falls; **Sewell Coal**; elevation, 3485′ B.

	Ft.	In.
Sandstone, massive, with small pebbles, **Lower Guyandot**	67	0
Shale, sandy, with iron ore. **Hartridge**	3	0
Coal, medium-soft	4	8
Shale		

A sample (No. 230R) collected from this opening was analyzed on a dry basis in the private laboratory of the West Virginia Pulp & Paper Company, at Luke, Md., with the following results:

	Per cent.
Volatile combustible matter	31.73
Fixed Carbon	65.10
Ash	3.17
Total	100.00
Sulphur	0.60
B. T. U.	14,713

West Virginia Pulp & Paper Company Prospect (Isom Folks Opening)—No. 701 on Map II.

On Elk Mountain, between Valley Fork and main Elk River, 1.5 miles southwest of Blue Spring; **Sewell Coal**; elevation, 4010′ B.

	Ft.	In.
Sandstone, shaly		
Shale, dark, **Hartridge**	2	0
Coal, soft	2	0
Slate, pavement		

At this point the old prospect had fallen shut, the measurement being made at the outcrop. A sample (No. 203R) was collected from the coal, the composition of which is published under **Mine No. 701** in the Survey Table of Coal Analyses at the end of this Chapter.

Quantity of Sewell Coal Available.

The following table, prepared by Miss Buchanan from a planimetric measurement of the outcrop on Map II, and embracing the areal district outlined on Figure 20, shows the probable amount of Sewell Coal in the area treated in this Report:

Probable Amount of Sewell Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Hacker Valley	2	1.40	896	78,059,520	3,122,381
Holly	3	25.15	16,096	2,103,425,280	84,137,011
Fork Lick	4	89.20	57,088	9,947,013,120	397,880,525
Glade	3	90.95	58,208	7,606,621,440	304,264,857
Totals		206.70	132,288	19,735,119,360	789,404,774
Portion of Mingo District, Randolph County, South of Valley Fork of Elk	4	13.00	8,320	1,449,676,800	57,987,072
Totals		219.70	140,608	21,184,796,160	847,391,846

WELCH COAL.

The Welch Coal, previously discussed in Chapter VII, pages 205-6, coming 10 to 50 feet below the Sewell, and having at times a thickness of four feet or more, was noted principally in the valley of Elk River and its tributaries east of Webster Springs, and on the Gauley and its tributaries east of Bolair, as well as in a local area east of Centralia near the western edge of the county. In the southern end of the county, along the drainage of Williams and Cranberry Rivers, it was seldom observed, but it is believed that prospecting would reveal it in a considerable portion of this undeveloped region. In both its physical appearance and its chemical character, it is almost the exact counterpart of the Sewell, there being great difficulty in correctly correlating these two coals when only one has been prospected in a particular locality and when other stratigraphic evidence is concealed or

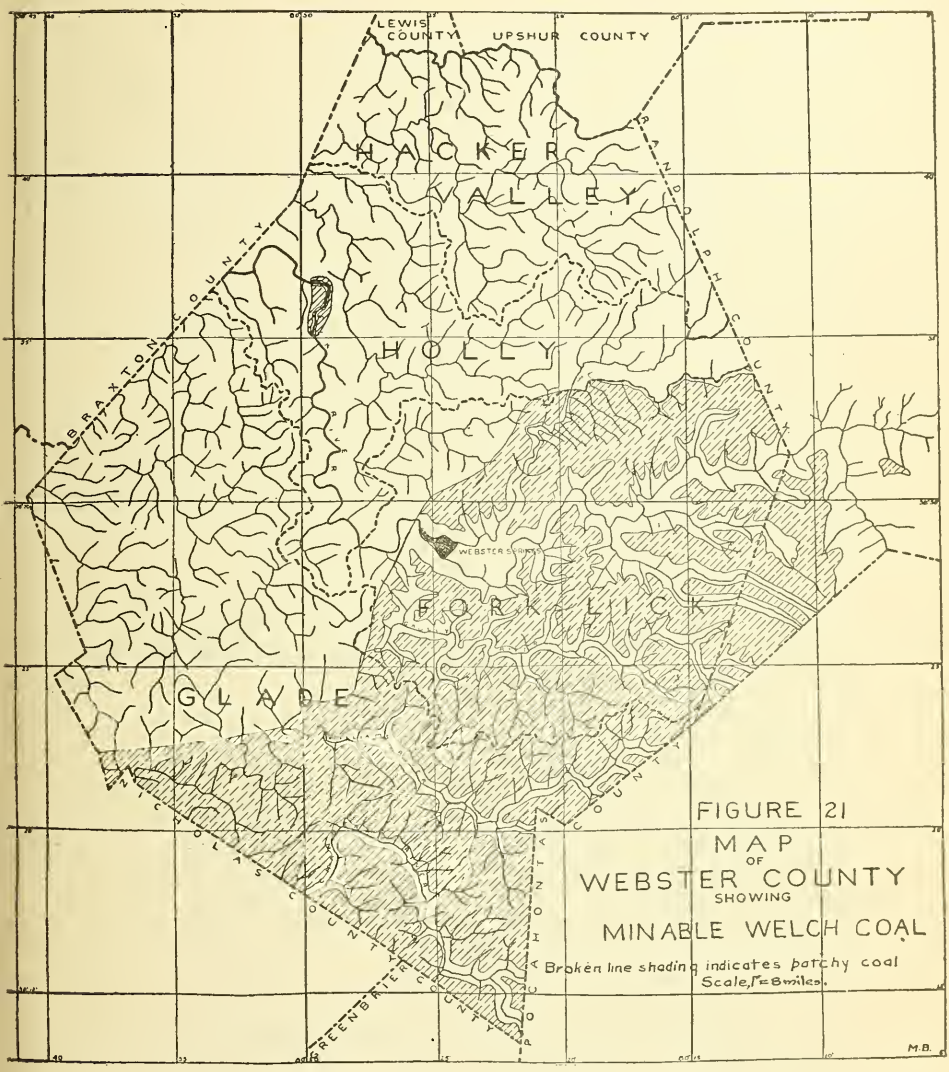


FIGURE 21

MAP OF WEBSTER COUNTY SHOWING MINABLE WELCH COAL

Broken line shading indicates patchy coal

Scale, 1"=8 miles.

lacking. The Welch Coal is usually free from slate partings and is low in sulphur, phosphorus, and ash. Figure 21 shows its areal extent in the regions where it is known or believed to be of commercial value, the broken line shading indicating a somewhat patchy development of the bed. Owing to its small vertical interval below the Sewell, its outcrop is not shown on Map II, but its position may be readily determined at any point from its relationship to that bed, the outcrop of which is delineated on the map.

Welch Coal, Holly District.

In Holly District the Welch Coal has been prospected over a small area along Elk River east of Centralia, as well as in the eastern end on Sugar Creek, the following openings having been observed:

Ezra Clifton Farm Mine—No. 702 on Map II.

On the east side of Elk River, 0.4 mile southward from the Clifton Ford and 1 mile southwest of Big Run Station; **Welch Coal**; elevation, 1025′ B.

	Ft.	In.
Sandstone, massive, **Welch**	10	0
Coal	2	0
Concealed to Elk River	2	0

A sample (No. 43) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 702** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Ezra Clifton Farm Mine—No. 703 on Map II.

On the east side of Elk River, 0.4 mile south of the Clifton Ford and 1 mile southwest of Big Run Station; **Welch Coal**; elevation, 1030′ B.

	Ft.	In.
Sandstone, massive, white, **Welch**	10	0
Coal, medium-soft	3	4
Slate, bony	1	1
Shale and concealed, to Elk River	3	0

A sample (No. 181R) was collected from this opening, the composition of which is published under Mine No. 703 in the Survey Table of Coal Analyses at the end of this Chapter.

Ezra Clifton Farm Mine—No. 704 on Map II.

On the east side of Elk River, 0.5 mile south of the Clifton Ford and 1 mile southwest of Big Run Station; Welch Coal; elevation, 1030′ B.

	Ft.	In.
Sandstone, massive, white, Welch	10	0
Coal, soft	3	5
Slate, bony, and concealed, to Elk River	3	0

Ezra Clifton Farm Mine—No. 705 on Map II.

On the east side of Elk River, 0.6 mile south of the Clifton Ford and 1.1 miles southwest of Big Run Station; Welch Coal; elevation, 1035′ B.

	Ft.	In.
Sandstone, massive		
Coal, soft	2	1
Concealed	10	0
Sandstone, in bed of Elk River		

At Prospect No. 706 on Map II, located on the east side of Elk River, 0.8 mile south of the Clifton Ford and 1.2 miles southwest of Big Run Station, at an elevation of 1040′ B., it was reported that the coal was once mined at an old mill dam. The opening had fallen shut, the statement of a resident being that the coal was 3 to 4 feet thick.

The two following exposures were noted in the eastern end of the district:

Holly Lumber Company Exposure—No. 707 on Map II.

On Sugar Creek, 1 mile east of the present location of Skelt Post-Office; Welch Coal; elevation, 2060′ B.

	Ft.	In.
Shale, sandy	20	0
Sandstone, massive	10	0
Coal	1	6
Shale, sandy, to creek	10	0

Holly Lumber Company Exposure—No. 708 on Map II.

On Sugar Creek, 1.5 miles eastward from the present location of Skelt Post-Office; **Welch Coal**; elevation, 2085′ B.

	Ft.	In.
Fire clay shale, from Sewell Coal	5	0
Coal, soft	2	4
Slate, dark	2	0
Fire clay shale to creek	1	0

Welch Coal, Fork Lick District

In Fork Lick District the Welch Coal was noted principally on Elk River and its tributaries east of Webster Springs and on Gauley River east of Bolair, the coal having been prospected at numerous points in both drainage basins. On the Elk the following openings were observed:

Patrick Daugherty Farm Mine—No. 709 on Map II.

On the south side of Elk River, 0.9 mile southwest of Webster Springs; **Welch Coal**; elevation, 2385′ B.

		Ft.	In.
Slate, dark			
Coal, soft, columnar	2′ 1″		
Slate, bony	0 1		
Coal, hard	0 10	3	0
Shale, gray, with plant rootlets			

E. H. Gillespie Prospect—No. 710 on Map II.

On the north side of Back Fork of Elk River, 0.8 mile northeast of Webster Springs; **Welch Coal**; elevation, 2220′ B.

		Ft.	In.
Slate, dark			
Coal, soft	1′ 3″		
Coal, bony	0 2		
Coal, soft	0 6	1	11
Slate, pavement			

George Mollohan Farm Mine—No. 711 on Map II.

On Mill Run of Back Fork of Elk River, 1.6 miles northeast of Webster Springs; **Welch Coal**; elevation, 2135′ B.

		Ft.	In.
Sandstone, massive			
Slate, dark		3	0
Coal, slaty	1′ 5″		
Coal, soft	1 6	2	11
Slate, pavement			

At the **Camden-Johnson Tract Exposure** (No. 712 on Map II), located on Laurel Run of Back Fork of Elk River, 0.2 mile northward from Breece, there was visible 2 feet of bony slate and coal at the Welch horizon, having an elevation of 2055′ B., and coming five feet below the Sewell.

Camden-Johnson Tract Prospect—No. 713 on Map II.

On Back Fork of Elk River, 1.1 miles northeast of Breece; **Welch Coal**; elevation, 1890′ B.

	Ft.	In.
Concealed and sandy shale from Sewell Coal	25	0
Coal	2	3
Slate, pavement		

Coal Prospect—No. 714 on Map II.

On Back Fork of Elk River, 1.6 miles northeast of Breece; **Welch Coal**; elevation, 1860′ B.

	Ft.	In.
Shale, sandy	6	0
Coal, soft, visible	1	4
Concealed	1	0
Sandstone, shaly	7	0
Sandstone, massive, in river		

Holly Lumber Company Prospect—No. 715 on Map II.

On Back Fork of Elk River, 1.7 miles northeast of Breece; **Welch Coal**; elevation, 1855′ B.

		Ft.	In.
Sandstone, massive			
Shale, sandy, dark		15	0
Sandstone, shaly		10	0
Slate, black, cannelly		3	0
Coal, soft	2′ 5″		
Slate, gray	0 3		
Coal, soft	0 6	3	2
Sandstone, massive, to river		15	0

A sample (No. 9) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 715** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Coal Prospect No. 716 on Map II, located on Back Fork of Elk River, 2 miles southwest of the present location of Skelt Post-Office, at an elevation of 1910′ B., had fallen shut, there being some cannel slate visible on the dump.

Lee A. Hamrick Prospect—No. 717 on Map II.

On Back Fork of Elk River, 1.7 miles southwest of the present location of Skelt Post-Office; **Welch Coal**; elevation, 1895′ B.

	Ft.	In.
Shale, sandy	10	0
Slate, black, cannel	1	0
Coal, soft	1	1
Fire clay shale	4	0
Concealed to river	6	0

Holly Lumber Company Prospect—No. 718 on Map II.

On Back Fork of Elk River, 1.3 miles southeast of Skelt; **Welch Coal**; elevation, 2095′ B.

			Ft.	In.
Coal blossom				
Concealed and shale			10	0
Coal	1′	3″		
Slate, dark	1	9		
Coal	1	2	4	2
Slate, pavement				

On main Elk River east of Webster Springs the following openings were noted:

E. H. Morton Prospect—No. 719 on Map II.

On the south side of Elk River, 1 mile southeast of Webster Springs; **Welch Coal**; elevation, 2485′ B.

			Ft.	In.
Sandstone, massive, **Welch**			10	0
Coal, soft	2′	0″		
Coal, hard, splinty	1	5	3	5
Slate, pavement				

The P. B. Weatherhead Prospect (No. 720 on Map II), located on the north side of Elk River, 1.1 miles southwest of Ralph, at an elevation of 2330′ B., had partly fallen shut, there being 1 foot of coal visible. According to Geo. A. Hechmer this prospect measured 3′ 0″ of clean coal.

PLATE XXXI (a).—View of Cedar Grove Sandstone, 0.2 mile east of Pleasant Ridge School, 2 miles southwest of Bolair.

PLATE XXXI (b).—View at Bolair looking up Gauley River; Topography of Pottsville Series.

Charles Bourn Farm Mine—No. 721 on Map II.

On the north side of Elk River, 0.8 mile southwest of Ralph; **Welch Coal**; elevation, 2340′ B.

	Ft.	In.
Shale, dark, sandy	7	0
Coal, medium-soft	3	0
Slate, black, bony	0	4
Shale, gray, pavement		

The Henry Miller Prospect (No. 722 on Map II), located on the north side of Point Mountain, 0.4 mile southwest of Ralph, at an elevation of 2345′ B., had fallen shut, the coal being reported 3′ 0″ thick.

Pardee & Curtin Lumber Company Farm Mine (F. F. Cowger Opening)—No. 723 on Map II.

On Leatherwood Creek, 0.8 mile southeast of Bergoo village; **Welch Coal**; elevation, 2710′ B.

		Ft.	In.
1. Shale, dark, sandy		11	0
2. **Coal**, soft	0′ 5″		
3. **Coal**, cannelly	0 6		
4. **Coal**, soft	2 3		
5. **Coal**, harder	0 8		
6. **Coal**, soft	0 5	4	3
7. Slate, pavement			

A sample (No. 198R) was collected from Nos. 2, 3, 4, 5 and 6 of section, the composition of which is published under **Mine No. 723** in the Survey Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Farm Mine (W. G. Hamrick Opening)—No. 724 on Map II.

On Leatherwood Creek, 0.8 mile southeast of Bergoo village; **Welch Coal**; elevation, 2715′ B.

		Ft.	In.
Shale, dark		15	0
Coal, soft	0′ 5″		
Coal, cannelly	0 6		
Coal, soft	3 3	4	2
Slate, pavement			

Pardee & Curtin Lumber Company Farm Mine (A. L. Cummings Opening)—No. 725 on Map II.

On Leatherwood Creek, 0.9 mile southeast of Bergoo village; Welch Coal; elevation, 2715′ B.

			Ft.	In.
Shale, dark			15	0
Coal, soft	0′	5″		
Coal, cannelly	0	5		
Coal, soft	3	7	4	5
Slate, pavement				

A sample (No. 6) was collected from this opening by D. D. Teets, Jr., the composition of which is published under Mine No. 725 in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Farm Mine (J. M. Miller Opening)—No. 726 on Map II.

On Leatherwood Creek, 1 mile southeast of Bergoo village; Welch Coal; elevation, 2715′ B.

			Ft.	In.
Shale, dark				
Coal, soft	0′	4″		
Coal, cannelly	0	5		
Coal, soft	3	3	4	0
Slate, pavement				

Pardee & Curtin Lumber Company Farm Mine (Adam J. Hamrick Opening)—No. 727 on Map II.

On Leatherwood Creek, 1.4 miles southeast of Bergoo village; Welch Coal; elevation, 2755′ B.

			Ft.	In.
Shale, dark, ferruginous			10	0
Coal, soft	0′	5″		
Coal, cannelly	0	7		
Coal, soft	2	4	3	4
Slate, pavement				

A sample (No. 11) was collected from this opening by D. D. Teets, Jr., the composition of which is published under Mine No. 727 in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Farm Mine (Robert Green Opening)—No. 728 on Map II.

On the south side of Bergoo Creek, 1.4 miles eastward from Bergoo village; **Welch Coal**; elevation, 2730′ B.

			Ft.	In.
Slate, black, cannel			3	6
Shale, dark			8	0
Coal, cannel	0′	6″		
Coal, soft	3	6	4	0
Slate, dark, pavement				

Pardee & Curtin Lumber Company Farm Mine (David Hamrick Opening)—No. 729 on Map II.

On the south side of Bergoo Creek, 1.6 miles eastward from Bergoo village; **Welch Coal**; elevation, 2775′ B.

	Ft.	In.
Shale, dark	5	0
Coal, soft	4	0
Slate, pavement		

A sample (No. 14) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 729** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Pardee & Curtin Lumber Company Prospect (Elza Hamrick Opening)—No. 730 on Map II.

On the north side of Bergoo Creek, 2.6 miles northeast of Bergoo village; **Welch Coal**; elevation, 2770′ B.

	Ft.	In.
Sandstone, massive		
Coal, soft, with cannel streak at top	4	0
Slate, pavement		

Pardee & Curtin Lumber Company Farm Mine (Henry Hamrick Opening)—No. 731 on Map II.

On the south side of Elk River, 2.6 miles northeast of Bergoo village; **Welch Coal**; elevation, 2765′ B.

			Ft.	In.
Shale, sandy			15	0
Coal, soft	0′	4½″		
Slate, cannelly	0	0½		
Coal, soft	3	8	4	1
Slate, pavement				

A sample (No. 16) was collected from this opening by D. D. Teets, Jr., the composition of which is published under **Mine No. 731** in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The **Jacob Fisher Exposure (No. 731A on Map II)**, located on Big Run of Elk River, 0.9 mile southeast of Waneta, at an elevation of 3080′ B., was reported to have measured 1′ 0″ of coal.

Pardee & Curtin Lumber Company Farm Mine (G. A. Sycefoose Opening)—No. 732 on Map II.

On the south side of Elk River, 2.8 miles southwest of Samp; **Welch Coal**; elevation, 2870′ B.

	Ft.	In.
Sandstone, massive, Welch	40	0
Slate, dark	2	0
Coal, medium-soft	4	10
Slate, dark, pavement		

A sample (No. 202R) was collected from this opening, the composition of which is published under **Mine No. 732** in the Survey Table of Coal Analyses at the end of this Chapter.

On Gauley River the Welch Coal rises above drainage about one mile west of Bolair and remains above all the way east to the Randolph County Line, the following openings having been observed:

The **Arthur Bankhead Prospect (No. 733 on Map II)**, located on Sandy Run of Gauley, 1.2 miles northeast of Bolair, at an elevation of 2590′ B., had fallen shut, its thickness not being learned.

John W. Payne Farm Mine—No. 734 on Map II.

On Sandy Run of Gauley River, 1.4 miles northeast of Bolair; **Welch Coal**; elevation, 2580′ B.

			Ft.	In.
1. Shale, dark, sandy			5	0
2. **Coal**, soft	2′	5″		
3. **Coal**, hard, splinty	0	7		
4. **Coal**, soft	0	2	3	2

A sample (No. 195R) was collected from Nos. 2, 3, and 4 of section, the composition of which is published under Mine No. 734 in the Survey Table of Coal Analyses at the end of this Chapter.

The Zebulon Bee Heirs Farm Mine (No. 735 on Map II), located on the south side of Gauley, 0.6 mile southeast of Bolair, at an elevation of 2515′ B., was partly filled with water, its apparent thickness being three feet or more.

Zebulon Bee Heirs Farm Mine—No. 736 on Map II.

On the south side of Gauley River, 0.7 mile southeast of Bolair; Welch Coal; elevation, 2525′ B.

			Ft.	In.
Shale, dark, sandy				
Coal, soft	2′	3″		
Coal, hard, bony	0	6½		
Coal, soft	1	2		
Slate, bony	0	1		
Coal, soft	0	3½	4	4
Slate, pavement				

A sample (No. 49) was collected from this opening by D. D. Teets, Jr., the composition of which is published under Mine No. 736 in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

E. H. Morton Farm Mine—No. 737 on Map II.

On the north side of Gauley River, 1.2 miles northeast of Bolair; Welch Coal; elevation, 2595′ B.

			Ft.	In.
1. Shale, dark				
2. Coal, medium-soft	2′	6″		
3. Coal, bony splint	0	4		
4. Coal, medium-soft	2	3	5	1
5. Slate, pavement				

A sample (No. 212R) was collected from Nos. 2, 3, and 4 of section, the composition of which is published under Mine No. 737 in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 47) was collected by D. D. Teets, Jr., the composition of which is published under the same mine number (737) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Cherry River Boom and Lumber Company Prospect (Heaston Dodrill Opening)—No. 738 on Map II.

On the south side of Gauley River, 0.3 mile eastward from the mouth of Turkey Creek; **Welch Coal**; elevation, 2510′ B.

			Ft.	In.
1. Slate and sandstone, from Sewell Coal			2	6
2. Coal, soft	1′	1″		
3. Bone	0	2		
4. Coal, soft	2	0	3	3
5. Slate, pavement				

A sample (No. 204R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 738** in the Survey Table of Coal Analyses at the end of this Chapter.

Welch Coal, Glade District.

On the Williams and Cranberry Rivers where the horizon of the Welch Coal is above drainage, it has not been opened so far as known, and as the coals in this great wooded area are mostly covered with a thick mantle of dirt and debris, making natural exposures very scarce, extensive prospecting will be necessary to reveal the character and worth of the coal.

Welch Coal, Mingo District, Randolph County.

In that portion of Mingo District, Randolph County, lying south of Valley Fork of Elk River, and included in this Report, no prospects were observed in the Welch Coal, but its close proximity to the region farther down Elk where the coal has been frequently opened would indicate that it could be found over most of this area.

Quantity of Welch Coal Available.

The following table, prepared by Miss Buchanan and with its acreage column based on the relationship between the Welch and Sewell Coals, and having the estimated thicknesses reduced to compensate for the somewhat patchy na-

ture of the seam, shows the probable amount of Welch Coal in the territory of this Report:

Probable Amount of Welch Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Holly	2	0.30	192	16,727,040	669,082
Fork Lick	3	89.90	57,536	7,518,804,480	300,752,179
Glade	2	92.55	59,232	5,160,291,840	206,411,673
Totals		182.75	116,960	12,695,823,360	507.832,934
Portion of Mingo District of Randolph South of Valley Fork of Elk	3	14.00	8,960	1,170,892,800	46,835,712
Totals		196.75	125,920	13,866,716,160	554,668,646

FIRE CREEK COAL.

The Fire Creek Coal, previously discussed in Chapter VII, page 210, and coming only a few feet above the red Mauch Chunk Shales, seems to be of definite commercial value in two distinct areas, one being mainly west and southwest of Webster Springs, and the other south of the Cranberry River in the extreme southern end of the county. Elsewhere the basal unconformity of the Pottsville Series has caused its horizon to be occupied by red shales which often occur only a few feet below the Welch Coal. As a fuel the Fire Creek Coal of Webster does not seem to have as much value as the Sewell, since it contains more slate and bony material, and as a commercial mining proposition its exploitation will be less satisfactory since its occurrence is more patchy. Figure 22 shows the two areas where it is considered to be of value and on Map II its outcrop is delineated for these two regions.

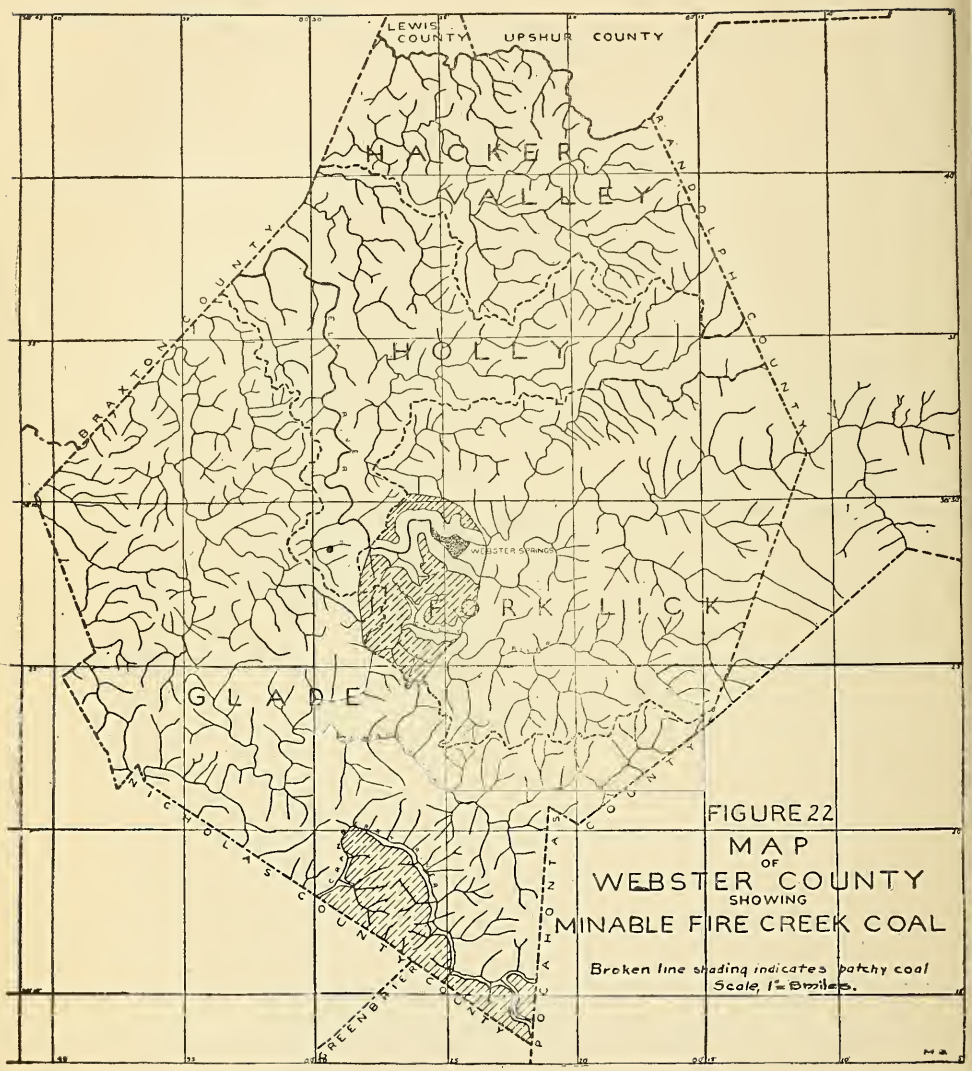


FIGURE 22

MAP OF WEBSTER COUNTY SHOWING MINABLE FIRE CREEK COAL

Broken line shading indicates patchy coal

Scale, 1" = 8 miles.

Fire Creek Coal, Holly District.

In Holly District the Fire Creek Coal has been prospected at a few points along Elk River, west of Webster Springs, the following openings having been noted:

The **W. B. Tracy Prospect (No. 741 on Map II)**, located on the north side of Elk River, 1.5 miles northwest of Skidmore Crossing, at an elevation of 1405′ B., had fallen shut, its thickness not being learned.

The **W. B. Tracy Prospect (No. 742 on Map II)**, located on the north side of Elk River, 1.1 miles westward from Skidmore Crossing, at an elevation of 1580′ B., had fallen shut, the thickness of the coal not being learned.

Neither of the above prospects showed signs of having found much coal, being evidently near the western feather edge of the Fire Creek area.

Fire Creek Coal, Fork Lick District.

In Fork Lick District, in the region north of Elk River, the Fire Creek Coal has been noted in a narrow strip about four miles long lying north and northwest of Webster Springs. South of Elk River the same belt extends across to Gauley River, having its best development at the well known Miller Opening at Bolair, and probably being of fair development southward to the Glade District Line, along the Gauley-Williams divide.

On Elk River the following openings and exposures were noted:

West Virginia Midland Railroad Exposure—No. 743 on Map II.

On the north side of Elk River, 0.9 mile westward from Skidmore Crossing; Fire Creek Coal; elevation, 1620′ B.

	Ft.	In.
Shale, dark	8	0
Coal	1	8
Fire clay shale	3	0
Shale, red, to grade	5	0

D. P. Kessler Farm Mine—No. 744 on Map II.

On Kingfisher Creek, 1.8 miles southwest of Webster Springs; **Fire Creek Coal**; elevation, 2230′ B.

			Ft.	In.
1. Shale, sandy			8	0
2. **Coal**, soft	2′	2″		
3. **Coal**, hard, bony	0	7		
4. **Coal**, medium-soft	1	6		
5. Slate, bony	0	2		
6. **Coal**, soft	0	3	4	8
7. Slate, pavement				

A sample (No. 176R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 744** in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 46) was collected by D. D. Teets, Jr., the composition of which is published under the same mine number (744) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

Coal Exposure—No. 745 on Map II.

In the old abandoned public road south of Elk River and 0.9 mile southeast of Webster Springs; **Fire Creek Coal**; elevation, 2285′ L.

	Ft.	In.
Shale, sandy		
Coal, somewhat slaty	2	8
Fire clay shale and concealed to red shale	45	0

At **Coal Exposure No. 746 on Map II**, located on the Summersville and Slaven Cabin Pike, south of Elk River and 0.9 mile southwest of Webster Springs, there was visible about 2 feet of coal at the Fire Creek blossom, having an elevation of 2285′ B.

E. H. Gillespie Prospect—No. 747 on Map II.

On the north side of Back Fork of Elk River, 0.7 mile northeastward from Webster Springs; **Fire Creek Coal**; elevation, 2170′ B.

	Ft.	In.
Slate, black	15	0
Coal, hard	2	11
Shale, pavement		

On the Gauley River the coal has been opened in the vicinity of Bolair. The **Sol. Starcher Prospect (No. 748 on Map II)**, located on the north side of Gauley, immediately north of Bolair, at an elevation of 2305′ B., had fallen shut, its thickness not being learned.

J. J. Miller Farm Mine—No. 749 on Map II.

On the north side of Gauley River, 0.4 mile northeast of Bolair; **Fire Creek Coal**; elevation, 2310′ B.

			Ft.	In.
1. Slate, dark				
2. **Coal**, medium-hard, roof	1′	8″		
3. **Coal**, soft	1	0		
4. **Coal**, bony splint	0	4		
5. **Coal**, medium-soft	3	2		
6. **Coal**, bony splint	0	4		
7. **Coal**, medium-soft	1	8	8	2
8. Slate, pavement				

A sample (No. 177R) was collected from Nos. 3, 4, 5, 6 and 7 of section, the composition of which is published under **Mine No. 749** in the Survey Table of Coal Analyses at the end of this Chapter. Another sample (No. 48) was collected by D. D. Teets, Jr., the composition of which is published under the same mine number (749) in the Bethlehem Steel Company Table of Coal Analyses at the end of this Chapter.

The above opening reveals an abnormal development of the Fire Creek Coal, there being no other exposure in the county that shows a corresponding thickness in this bed.

Fire Creek Coal, Glade District.

In Glade District the Fire Creek Coal seems to be of value mainly on the south side of Cranberry River at the extreme southern end of the county, where it has been prospected at a few points. On the Williams River it does not appear to be of much value, the following being the only exposure noted on that stream:

Cherry River Boom and Lumber Company Exposure—No. 750 on Map II.

On Little Fork of Williams River, 1.3 miles south of Three Forks of Williams; **Fire Creek Coal**; elevation, 2670′ B.

	Ft.	In.
Sandstone, massive	15	0
Slate, black	5	0
Coal	0	2
Fire clay shale	5	0

On the Cranberry River the following openings were noted:

Cherry River Boom and Lumber Company (Camden-McGraw Tract) Prospect—No. 751 on Map II.

On the south side of Cranberry River, 0.4 mile eastward from Bee Run, and 0.2 mile from Nicholas-Webster line; **Fire Creek Coal**; elevation, 2275′ B.

	Ft.	In.
Sandstone, massive		
Coal, soft	1	10
Slate and concealed to river	15	0

A sample (No. 209R) was collected from this opening, the composition of which is published under **Mine No. 751** in the Survey Table of Coal Analyses at the end of this Chapter.

Cherry River Boom and Lumber Company Exposure—No. 752 on Map II.

On Lick Branch of Cranberry River, 0.2 mile above its mouth; **Fire Creek Coal**; elevation, 2760′ B.

	Ft.	In.
Shale, gray, flaggy	10	0
Coal, soft	0	6
Shale		

The **Cherry River Boom and Lumber Company (Camden-McGraw Tract) Prospect—(No. 753 on Map II)**, located on Dogway Fork of Cranberry River, 0.8 mile northward from Dogway village, at an elevation of 3065′ B., had fallen shut, its thickness not being learned.

Cherry River Boom and Lumber Company (Camden-McGraw Tract) Prospect—No. 754 on Map II.

On Dogway Fork of Cranberry River, 0.5 mile northward from Dogway village; **Fire Creek Coal**; elevation, 3060′ B.

			Ft.	In.
1. Shale, sandy			20	0
2. Coal, soft	2′	0″		
3. Slate, black, bony	1	0		
4. Coal	1	6	4	6
5. Slate, pavement				

A sample (No. 210R) was collected from Nos. 2 and 4 of section, the composition of which is published under **Mine No. 754** in the Survey Table of Coal Analyses at the end of this Chapter.

The **Cherry River Boom and Lumber Company (Camden-McGraw Tract) Prospect—(No. 755 on Map II)**, located on Dogway Fork of Cranberry River, 0.3 mile north of Dogway village, at an elevation of 3085′ B., had fallen shut, its thickness not being learned.

Quantity of Fire Creek Coal Available.

The following table, compiled by Miss Buchanan from a planimetric determination of the acreage of the two regions outlined on Figure 22, gives the probable amount of Fire Creek Coal for the county:

Probable Amount of Fire Creek Coal.

Webster County by Districts	Thickness of Coal Assumed. Feet	Square Miles	Acres	Cubic Feet of Coal	Short Tons of Coal
Fork Lick	4	11.65	7,456	1,299,133,440	51,965,337
Glade	3	16.10	10,304	1,346,526,720	53,861,069
Totals		27.75	17,760	2,645,660,160	105,826,406

SUMMARY OF AVAILABLE COAL.

For convenience of reference, all the mines and prospects described in this Report have been given serial numbers which are printed in blue on Map II, along with the conventional mine symbols. Disregarding those that are applied to thin coals that have no commercial significance, the following table, compiled by Mr. Tucker, gives a list of these numbers that refer to the 19 commercial seams described in the present Chapter, as well as a summary of the total amount of coal that each seam is estimated to contain:

Summary of Available Coal by Districts.

Coal Bed.	Mines and Prospects listed on Map II and Described in Chapter X	Webster County.				Randolph Co.	Total.
		Hacker Valley.	Holly.	Fork Lick.	Glade.	Mingo, South of Elk River.	
Upper Freeport	1- 14	2,297,180	5,174,231	.....	17,217,700	.....	24,689,111
Upper Kittanning	18- 31	32,483,912	36,531,855	2,408,694	75,673,129	.....	147,097,590
Middle Kittanning	32- 43	62,224,589	59,380,992	4,683,571	152,104,550	.....	278,393,702
Lower Kittanning	44-134	144,131,328	124,337,634	11,430,144	145,246,464	.....	425,145,600
Upper Mercer	135-157	85,530,931	71,591,731	8,252,006	103,150,080	.....	268,524,748
Stockton	158-208	151,881,523	126,289,452	15,388,877	192,695,501	.....	486,255,053
Coalburg	209-220	.....	44,605,440	10,482,278	137,830,810	.....	192,918,528
Winifrede	221-235	85,475,174	76,442,573	14,217,984	116,587,469	.....	292,723,200
Chilton	236-252	89,489,664	109,617,869	22,637,261	125,201,894	.....	346,946,688
Cedar Grove	253-269	.....	89,991,475	25,648,128	183,439,872	.....	299,079,475
Alma	273-280	.....	17,897,933	9,868,954	18,567,014	.....	46,333,901
Campbell Creek (Peerless)	281-374	139,726,541	137,830,810	36,576,461	210,314,649	.....	524,448,461
Eagle	387-508	199,888,128	204,627,456	73,738,368	316,001,664	.....	794,255,616
Lower War Eagle	519-530	25,257,831	34,875,878	5,519,923	.....	.....	65,653,632
Gilbert	531-544	30,108,672	92,612,045	62,837,913	166,099,507	2,341,786	353,999,923
Hughes Ferry	553-567	9,478,656	40,312,166	154,000,282	154,557,850	17,619,149	375,968,103
Sewell	584-701	3,122,381	84,137,011	397,880,525	304,264,857	57,987,072	847,391,846
Welch	702-738	.....	669,082	300,752,179	206,411,673	46,835,712	554,668,646
Fire Creek	741-755	.....	.....	51,965,337	53,861,069	.....	105,826,406
Totals		1,061,096,510	1,356,925,363	1,208,288,885	2,679,225,752	124,783,719	6,430,320,229

Webster County Total = 6,305,536,510 short tons.

The above table represents the amount of coal believed to be available in the territory of this Report. Only a few thousand tons have already been mined, making an amount that is entirely negligible compared to the sum total as given in the present estimate. Allowing for a total recovery of 80 per cent., the total coal that may eventually be mined is, in round numbers, 5,144,000,000 short tons.

MINABLE COALS BY MAGISTERIAL DISTRICTS.

The minable coals of Webster and the small portion of Mingo District, Randolph County, treated in this Report, have been discussed by Magisterial Districts on previous pages of this Chapter. In the Index, at the end of this Report, under the heading "Minable Coals by Magisterial Districts," will be found a list of page references making this information readily available without further discussion.

GEOLOGICAL SURVEY TABLE OF COAL ANALYSES.

The following table, compiled by Mr. Tucker, containing the proximate analyses of 61 mines and prospects, together with the ultimate analyses, calorific determinations, and fuel ratios of some of these, is the exclusive work of members of the Survey Staff. All the samples were taken by members of the force in the field, being collected in small bags with as much care as was practicable when depending on the scanty saddle-bag equipment such as could be carried in a region as rough as the one under discussion.

The chemical work was done by J. B. Krak, Assistant Chemist, working under the direction and with the assistance of B. H. Hite, Chief Chemist, in the Laboratory of the Survey at Morgantown.

In addition to the analyses given in the table, numerous others are presented on the preceding pages of this Chapter along with the descriptions of the mines from which they were taken, some of which were made by the Chemists of the Surrvey from samples submitted by the mine owners, while others represent samples that were taken and analyzed by mining companies or other commercial testing organizations. Many of these are doubtless quite as accurate as those to be found in the Survey Table, but it is thought best to present them separately. In addition to these scattered and miscellaneous tests, the chemical work of the Bethlehem Steel Company has been compiled in a separate table, published with explanations on subsequent pages of this Chapter.

In the Survey Table below, the numbers in the left-hand margin correspond to the numbers given with the descriptions of the mines in the text and with the mine symbols on Map II. All samples were cut from the mining section of the seams unless otherwise described, the usual method being to discard from the samples such slates as would be discarded in ordinary commercial shipment:

Survey Table of Coal Analyses.

No. on Map II	Mine.	County.	Coal Bed.	Condition of Sample.	Proximate.				Common to Both.		Ultimate.					Calorimeter B. T. U. for 1 Lb. of Coal.	Calculated B. T. U. for 1 Lb. of Coal.	Carbon Divided by Oxygen + Ash
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.				
21	Charles Dever	W.	Upper Kittanning	A.R.	0.94	36.01	50.48	0.036	12.57	1.25								
27	Henry Waggy	W.	Upper Kittanning	A.R.	1.03	36.04	54.39	0.004	8.54	0.82								
31	Henry Good	W.	Upper Kittanning	A.R.	0.72	39.09	55.36	0.005	4.83	0.77								
	Average	W.	Upper Kittanning	A.R.	0.90	37.05	53.41	0.015	8.64	0.95								
37	Keystone Lumber & Mining Co.	W.	Middle Kittanning	A.R.	0.91	34.22	55.34	0.006	9.53	0.72								
39	Tioga Lumber Co. (Margaret Strange)	W.-N.	Middle Kittanning	A.R.	1.89	35.33	52.19	0.005	10.59	0.88								
	Average		Middle Kittanning	A.R.	1.40	34.78	53.76	0.0055	10.06	0.80								
69	John Ware	W.	Lower Kittanning	A.R.	0.93	35.61	53.42	0.013	10.04	0.76								
81	Jacob Gobeli	W.	Lower Kittanning	A.R.	1.03	36.67	59.37	0.019	2.93	2.79								
91	Pardee & Curtin Lumber Co.	W.	Lower Kittanning	A.R.	14.57	31.42	40.07	0.008	13.94	5.73								
117	Davis-Eakin Lumber Co. (Black Betsey Coal Co.)	W.	Lower Kittanning	A.R.	0.78	37.77	57.05	0.004	4.40	1.31								
119	Tioga Lumber Co. (Margaret Strange)	W.	Lower Kittanning	A.R.	0.79	33.78	53.93	0.007	11.50	0.77								
129	Henry Norman	W.	Lower Kittanning	A.R.	1.35	32.20	52.00	0.005	14.45	0.54								
156	Black Betsey Coal Co. (Abram Cobb)	W.	Lower Kittanning	A.R.	3.55	32.47	54.08	0.005	9.90	0.78								
	Average	W.	Lower Kittanning	A.R.	3.29	34.27	52.85	0.007	9.59	1.81								
184	Tanner & Cutlip	W.	Stockton (Lower Mercer)	A.R.	3.73	34.84	57.22	0.005	4.21	0.60								
217	Keystone Lumber & Mining Co.	W.	Coalburg	A.R.	0.55	30.99	51.66	0.062	7.80	1.28								
255	J. W. Brooks (171-R)	W.	Cedar Grove	A.R.	1.16	33.55	58.22	0.005	7.07	1.00								
255	J. W. Brooks (238-R)	W.	Cedar Grove	A.R.	0.55	32.43	54.27	0.012	12.75	3.49								
	Average	W.	Cedar Grove	A.R.	0.85	32.99	56.25	0.0085	9.91	2.25								
289	Oliver Williams	W.	Campbell Creek (Peerless)	A.R.	1.03	33.34	61.87	0.008	3.76	0.84								
299	John T. McGraw (Bias Cogar)	W.	Campbell Creek (Peerless)	A.R.	0.22	33.45	64.08	0.009	2.25	0.82								
314*	Reece & McCabe	W.	Campbell Creek (Peerless)	A.R.	0.54	30.96	34.10	0.050	34.40	0.67	53.10	3.98	6.80	1.05	9,500	9,600	1.29	

*Not included in average.

Survey Table of Coal Analyses—Continued.

No. on Map II.	Mine.	County.	Coal Bed.	Condition of Sample.	Proximate.				Common to Both.		Ultimate.					Calorimeter B. T. U. for 1 Lb. of Coal.	Calculated B. T. U. for 1 Lb. of Coal.	Carbon Divided by Oxygen + Ash
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.				
334	Arcola Coal Co.	W.	Campbell Creek (Peerless)	A.R.	0.69	35.83	58.27	0.004	5.21	0.96								
339	Smoot Lumber Co.	W.	Campbell Creek (Peerless)	A.R.	0.64	37.66	59.79	0.005	1.91	0.74								
354	Watson Hollister	W.	Campbell Creek (Peerless)	A.R.	0.78	38.01	59.26	0.004	1.95	0.67								
	Average	W.	Campbell Creek (Peerless)	A.R.	0.67	35.66	60.65	0.006	3.02	0.81								
385	Keystone Lumber & Mining Co.	W.	Powellton	A.R.	0.72	35.56	57.48	0.005	6.24	2.78								
387	John T. McGraw	W.	Eagle	A.R.	1.52	36.19	57.46	0.011	4.83	1.35								
398	Mayton Lumber Co.	W.	Eagle	A.R.	1.02	35.32	57.23	0.004	6.43	3.28								
416	Oldlick Run Coal & Coke Co. (233-R)	W.	Eagle	A.R	0.85	35.99	50.72	0.009	12.44	0.55	77.83	4.21	3.64	1.33	13,450	13,670	4.84	
416	Oldlick Run Coal & Coke Co. (170-R)	W.	Eagle	A.R	0.42	36.04	51.12	0.007	12.42	5.86								
440	William Fisher	W.	Eagle	A.R.	1.33	32.45	49.21	0.010	17.01	6.50								
504	Birch River Coal Co.	W.	Eagle	A.R.	0.89	36.73	58.48	0.004	3.90	2.69								
	Average	W.	Eagle	A.R.	1.00	35.45	54.04	0.0075	9.51	3.37								
538	S. H. Fleming	W.	Gilbert	A.R.	0.71	34.84	54.38	0.004	10.07	5.10								
554	W. R. Cogar	W.	Hughes Ferry	A.R.	0.30	32.01	56.90	0.010	10.79	2.06								
556	John Rusmisell	W.	Hughes Ferry	A.R.	0.63	30.90	63.83	0.009	4.64	1.32								
565	Cherry River Boom & Lumber Co. (J. C. Mullens)	W.	Hughes Ferry	A.R.	4.02	33.54	58.28	0.200	4.16	0.76								
	Average	W.	Hughes Ferry	A.R.	1.65	32.15	59.67	0.073	6.53	1.38								
591	Benedum Brothers	W.	Sewell	A.R.	1.16	33.34	59.15	0.010	6.35	0.58								
600	Holly Lumber Co.	W.	Sewell	A.R.	0.53	28.17	55.26	0.016	16.04	0.89								
601	Ranwood Lumber Company	W.	Sewell	A.R.	0.67	29.56	65.35	0.008	4.42	0.56								
612	E. H. Gillespie	W.	Sewell	A.R.	0.47	30.99	63.71	0.003	4.83	0.60								
617	Bailey Fisher	W.	Sewell	A.R.	0.19	33.31	61.86	0.034	4.64	0.47								
622	Holly-Elk Coal Co.	W.	Sewell	A.R.	0.88	30.78	63.27	0.083	5.07	0.63								
638	Pardee & Curtin Lumber Co. (Dyer Run)	W.	Sewell	A.R.	0.86	32.87	61.48	0.004	4.79	0.69								

No. on Map II.	Mine.	County.	Coal Bed.	Condition of Sample.	Proximate.				Common to Both.		Ultimate.				Calorimeter B. T. U. for 1 Lb. of Coal.	Calculated B. T. U. for 1 Lb. of Coal.	Carbon Divided by Oxygen *Ash.
					Moisture.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon	Hydrogen.	Oxygen.	Nitrogen.			
643	H. W. Cogar	W.	Sewell	A.R	2.76	30.90	61.09	0.007	5.25	0.65	....	....	....	....	....	....	....
650	Pardee & Curtin Lumber Co. (Henry Dodrill)	W.	Sewell	A.R	0.75	24.24	69.88	0.005	5.13	0.56	....	....	....	....	....	....	....
652	Pardee & Curtin Lumber Co.	W.	Sewell	A.R	2.52	31.59	59.36	0.012	6.53	0.56	....	....	....	....	....	....	....
653	Pardee & Curtin Lumber Co. (Eliza Hamrick)	W.	Sewell	A.R	0.78	27.35	62.78	0.017	9.09	0.67	....	....	....	....	....	....	....
654	Pardee & Curtin Lumber Co. (Robert Rose)	W.	Sewell	A.R	0.66	29.07	63.67	0.010	6.60	0.71	....	....	....	....	....	....	....
660	Jacob Fisher (Lee A. Hamrick)	W.	Sewell	A.R	1.24	31.47	62.62	0.005	4.67	0.44	....	....	....	....	....	....	....
682	Pardee & Curtin Lumber Co. (Frazier)	W.	Sewell	A.R	0.82	29.24	64.74	0.010	5.20	0.58	....	....	....	....	....	....	....
688	Cherry River Boom & Lumber Co.	W.	Sewell	A.R	0.78	30.38	63.92	0.006	4.92	0.65	....	....	....	....	....	....	....
693	Cherry River Boom & Lumber Co. (John Leslie)	W.	Sewell	A.R	1.10	30.40	64.25	0.005	4.25	0.88	....	....	....	....	....	....	....
697	Cherry River Boom & Lumber Co.	W.	Sewell	A.R	0.51	28.12	48.48	0.380	22.89	0.71	....	....	....	....	....	....	....
701	W. Va. Pulp & Paper Co. (Ison Folks)	R.	Sewell	A.R	1.21	29.51	66.64	0.011	2.64	0.81	....	....	....	....	....	....	....
	Average	—	Sewell	A.R	1.00	30.07	62.08	0.0348	6.85	0.65	....	....	....	....	....	....	....
703	Ezra Clifton	W.	Welch	A.R	0.54	38.74	56.56	0.009	4.16	0.59	....	....	....	....	....	....	....
723	Pardee & Curtin Lumber Co. (F. F. Cowger)	W.	Welch	A.R	0.86	28.48	62.41	0.013	8.25	0.71	....	....	....	....	....	....	....
732	Pardee & Curtin Lumber Co. (G. S. Sycefoose)	W.	Welch	A.R	1.68	31.84	62.42	0.006	4.06	0.65	....	....	....	....	....	....	....
734	John W. Payne	W.	Welch	A.R	0.71	28.40	59.57	0.010	11.32	0.33	....	....	....	....	....	....	....
737	E. H. Morton	W.	Welch	A.R	0.74	28.50	60.51	0.010	10.25	0.52	....	....	....	....	....	....	....
738	Cherry River Boom & Lumber Co (Heaston Dodrill)	W.	Welch	A.R	0.57	29.74	64.06	0.066	5.63	0.92	....	....	....	....	....	....	....
	Average	W.	Welch	A.R	0.85	30.95	60.92	0.019	7.28	0.62	....	....	....	....	....	....	....
744	D. P. Kessler	W.	Fire Creek	A.R.	0.81	29.13	61.18	0.006	8.88	0.43	....	....	....	....	....	....	....
749	J. J. Miller	V.	Fire Creek	A.R.	0.76	30.52	61.45	0.005	7.27	0.69	....	....	....	....	....	....	....
751	Cherry River Boom & Lumber Co (Camden-McGraw)	W.	Fire Creek	A.R.	2.95	30.87	60.87	0.001	5.31	0.71	....	....	....	....	....	....	....
754	Cherry River Boom & Lumber Co (Camden-McGraw)	V.	Fire Creek	A.R.	0.64	25.81	59.46	0.042	14.09	0.71	....	....	....	....	....	....	....
	Average	W.	Fire Creek	A.R.	1.29	29.08	60.74	0.016	8.89	0.63	....	....	....	....	....	....	....
757	Henry Hamrick	W.	Pluto	A.R.	0.57	27.48	44.39	0.134	27.56	7.06	....	....	....	....	....	....	....
759	Pocahontas County Coal & Land Co.	P.	Big Spruce Knob	A.R.	0.91	25.81	38.29	0.040	34.99	2.78	....	....	....	....	....	....	....

Page References to Detailed Descriptions and Sections of Coal Mines Listed in Preceding Table

No. on Map II.	Sample No.	Coal Bed and Name of Owner.	Location	Page
		Upper Kittanning.		
21	166-R	Charles Dever	2.5 mi. S E. of Cleveland	285
27	188-R	Henry Waggy	1.9 mi. W. of Erbacon	278-8
31	190-R	Henry Good	1.5 mi. N. E. of Boggs	289
		Middle Kittanning		
37	187-R	Keystone Lumber & Mining Co.	3.0 mi. N. W. of Cowen	292
39	244-R	Tioga Lumber Co. (Margaret Strange)	1.5 mi. Westward from Boggs	293
		Lower Kittanning.		
69	169-R	John Ware	0.8 mi. S. W. of Wheeler	303
81	167-R	Jacob Gobeli	1.9 mi. Westward from Penbro	306
91	234-R	Pardee & Curtin Lumber Co.	0.8 mi. Northward from Summit	308
117	189-R	Davis-Eakin Lumber Co. (Black Betsey Coal Co.)	2.6 mi. N. E. of Skyles	315
119	1-P	Tioga Lumber Co. (Margaret Strange)	1.1 mi. Westward from Boggs	316
129	243-R	Henry Norman	1.2 mi. S. E. of Boggs	319
156	191-R	Black Betsey Coal Co. (Abram Cobb)	2.1 mi. N. E. of Boggs	327-8
		Stockton (Lower Mercer).		
184	235-R	Tanner & Cutlip	0.5 mi. S. E. of Diana	337
		Coalburg.		
217	186-R	Keystone Lumber & Mining Co.	2.9 mi. N. W. of Cowen	348
		Cedar Grove.		
255	171-R	J. W. Brooks	0.1 mi. S. E. of Summit	363-4
255	238-R	J. W. Brooks	0.1 mi. S. E. of Summit	363-4
		Campbell Creek (Peerless).		
289	215-R	Oliver Williams	0.8 mi. S. E. of Pisgah Knob	373
299	174-R	John T. McGraw (Bias Cogar)	2.7 mi. N. E. of Jumbo	375
314	894-H Braxton	Reece & McCabe	Opposite Prestonia	379-80
334	183-R	Arcola Coal Co.	0.2 mi. S. of Arcola	383
339	192-R	Smoot Lumber Co.	1.3 mi. S. E. of Jack	383-4
354	182-R	Watson Hollister	2.0 N. E. of Cowen	386
		Powellton.		
385	185-R	Keystone Lumber & Mining Co.	2.3 mi. N. W. of Cowen	171
		Eagle.		
387	217-S	John T. McGraw	1.1 mi. Eastward from Marpleton	393
398	168-R	Mayton Lumber Co.	1.1 S. W. of Hacker Valley	395
416	233-R	Oldlick Run Coal & Coke Co.	1.8 mi. N. E. of Salisbury	399
416	170-R	Oldlick Run Coal & Coke Co.	1.8 mi. N. E. of Salisbury	399
440	239-R	William Fisher	1.4 mi. Southward from Diana	404
504	184-R	Birch River Coal Co.	1.7 mi. N. W. of Cowen	418
		Gilbert.		
538	193-R	S. H. Fleming	1.2 mi. N. W. of Camden-on-Gauley	428-9
		Hughes Ferry.		
554	173-R	W. R. Cogar	0.3 mi. N. of Skelt	433
556	214-R	John Rusmisell	4.3 mi. S. W. of Pickens	433
565	207-R	Cherry River Boom & Lumber Co. (J. C. Mullens)	0.3 mi. S. of Three Forks of Williams River	435-6

Page References to Detailed Descriptions and Sections of Coal Mines Listed in Preceding Table—Continued.

No. on Map II.	Sample No.	Coal Bed and Name of Owner.	Location	Page
		Sewell.		
591	180-R	Benedum Brothers	1.0 mi. S. W. of Big Run	443
600	216-R	Holly Lumber Co	1.9 mi. E. of Skelt	446
601	213-R	Ranwood Lumber Co	.4 mi. Eastward from mouth of Mill Run	446-7
612	175-R	E. H. Gillespie	0.8 mi. N. E. of Webster Springs	450
617	172-R	Bailey Fisher	2.3 mi. N. E. of Webster Springs	451
622	237-R	Holly-Elk Coal Co	0.8 mi. N. E. of Ralph	452-3
638	178-R	Pardee & Curtin Lumber Co. (Dyer Run)	2.8 mi. S. E. of Ralph	456
643	196-R	H. W. Cogar	2.2 mi. S. E. of Ralph	458
650	179-R	Pardee & Curtin Lumber Co. (Henry Dodrill)	0.7 mi. Westward from Bergoo	459
652	197-R	Pardee & Curtin Lumber Co	3.2 mi. S. E. of Bergoo	460
653	200-R	Pardee & Curtin Lumber Co. (Elza Hamrick)	2.5 mi. N. E. of Bergoo	460
654	199-R	Pardee & Curtin Lumber Co. (Robert Rose)	4.0 mi. S. E. of Bergoo	460-1
660	162-R	Jacob Fisher (Lee A. Hamrick)	0.9 mi. S. E. of Waneta	462-3
582	205-R	Pardee & Curtin Lumber Co. (Frazier)	0.4 mi. N. E. of mouth of Jim Spring Run	467
688	194-R	Cherry River Boom & Lumber Co	0.4 mi. N. E. of mouth of Jim Spring Run	469
693	206-R	Cherry River Boom & Lumber Co. (John Leslie)	2.1 mi. W. of Three Forks of Williams	470
697	208-R	Cherry River Boom & Lumber Co	0.7 mi. N. E. of mouth of Middle Fork	471
701	203-R	W. Va. Pulp & Paper Co. (Isom Folks)	1.5 mi. S. W. of Blue Spring	473
		Welch.		
703	181-R	Ezra Clifton	1.0 mi. S W. of Big Run	476-7
723	198-R	Pardee & Curtin Lumber Co. (F. F. Cowger)	0.8 mi. S. E. of Bergoo	481
732	202-R	Pardee & Curtin Lumber Co. (G. A. Sycefoose)	2.8 mi. S. E. of Samp	484
734	195-R	John W. Payne	1.4 mi. N. E. of Bolair	484-5
737	212-R	E. H. Morton	1.2 mi. N. E. of Bolair	485
738	204-R	Cherry River Boom & Lumber Co. (Heaston Dodrill)	0.3 mi. Eastward from mouth of Turkey Creek	486
		Fire Creek.		
744	176-R	D. P. Kessler	1.8 mi. S. W. of Webster Springs	490
749	177-R	J. J. Miller	0.4 mi. N. E. of Bolair	491
751	209-R	Cherry River Boom & Lumber Co. (Camden-McGraw)	0.3 mi. Eastward from mouth of Bee Run	492
754	210-R	Cherry River Boom & Lumber Co. (Camden-McGraw)	0.5 mi. Northward from Dogway	493
		Pluto.		
757	201-R	Henry Hamrick	2.6 mi. N. E. of Bergoo	220
		Big Spruce Knob.		
759	4-R	Pocahontas County Coal & Land Co	S. W. base of Big Spruce Knob, 6.5 mi. N. W. of Marlinton	224-5

The analysis of a sample of Peerless Coal from the **Laurel Hill Mining Company (Main Opening) Mine—No. 331 on Map II,** a description of which appears on page 382 of this Report, submitted by Mr. Walker, Superintendent of the Company after the forms had been closed, made in the laboratory of the Survey, gave the following results, according to Messrs. Hite and Krak:

	Per cent.
Moisture	0.83
Volatile Matter	35.92
Fixed Carbon	56.79
Ash	6.46
Total	100.00
Sulphur	0.92
Phosphorus	0.006

BETHLEHEM STEEL COMPANY TABLE OF COAL ANALYSES.

The following table, compiled by Mr. Tucker, contains a list of 48 analyses of coal kindly offered to the Survey by the Bethlehem Steel Company through its Assistant Geologist, Mr. D. D. Teets, Jr., of Buckhannon, W. Va., who examined and sampled a large number of mines and prospects in Webster County during the same season that the writer was engaged in this region. The analyses of these samples taken by Mr. Teets, who for several years was a member of the Survey Staff, made by Mr. N. M. Newman, Chemist of the Bethlehem Steel Company, in its laboratory at Sparrows Point, Md., are doubtless as accurate as those of the Survey and make a most valuable addition to this Chapter.

Numbers in the left-hand column refer to the mine numbers printed on Map II, and the detailed descriptions of all these mines may be readily found by reference to the Index at the end of the volume:

Bethlehem Steel Company Table of Coal Analyses, Webster County.

Samples by D. D. Teets, Jr., shipped to Edwin Barnhart, Baltimore, Md., and analyzed by N. M. Newman, Chemist of Maryland Plant.

No. on Map II.	Mine.	Horizon.	Volatile Matter.	Fixed Carbon.	Phosphorus.	Ash.	Sulphur.	Carbon.	Hydrogen.	Oxygen	B. T. U.	B. T. U. Ash Free Coal.
3	John Tharp	Upper Freeport	39.60	54.60	0.014	5.80	1.65	....	....	....	....	....
71	J. A. Hinkle	Lower Kittanning	33.00	53.80	0.016	13.20	0.84	....	....	....	....	....
105	Jackson	Lower Kittanning	33.21	55.29	0.008	11.50	0.75	....	....	....	....	....
106	Floyd Harris	Lower Kittanning	34.01	53.69	0.015	12.30	0.90	....	....	....	....	....
108	Ross F. Stout	Lower Kittanning	30.16	55.74	0.018	14.10	1.20	....	....	....	....	....
	Average	Lower Kittanning	32.60	54.63	0.014	12.77	0.92	....	....	....	....	....
143	P. B. Bright	Upper Mercer	35.00	55.00	0.006	10.00	0.96	74.59	4.93	9.28	13,351	14,883
184	Tanner & Cutlip	Stockton (Lower Mercer)	35.61	55.34	0.006	9.05	0.96	....	....	....	....	....
199	Lock Gregory	Stockton (Lower Mercer)	34.60	59.90	0.004	5.50	1.32	....	....	....	....	....
	Average	Stockton (Lower Mercer)	35.11	57.62	0.005	7.27	1.14	....	....	....	....	....
309	George H. Miller	Peerless	33.80	59.70	0.016	6.50	0.81	78.30	5.03	9.08	13,962	14.932
311	John Gregory	Peerless	35.60	54.60	0.018	9.80	2.31	76.50	5.16	7.30	13,956	15,473
314*	Reece & McCabe	Peerless	25.50	33.00	0.049	41.50	0.67	....	....	....	....	....
	Average	Peerless	34.70	57.15	0.017	8.15	1.56	77.40	5.10	8.19	13,959	15,203
398	Mayton Lumber Co.	Eagle	35.87	52.28	0.007	11.85	6.15	....	....	....	....	....
428	Floyd Siffles	Eagle	37.08	52.60	0.014	10.32	5.26	....	....	....	....	....
433	James Lough	Eagle	35.96	58.04	0.016	5.00	1.40	....	....	....	....	....
453	Davis-Eakin Lumber Co.	Eagle	34.00	52.00	0.005	14.00	6.03	....	....	....	....	....
456	Davis-Eakin Lumber Co.	Eagle	39.44	53.36	0.007	7.20	1.89	....	....	....	....	....
466	William McWhorter	Eagle	33.12	53.38	0.006	13.50	6.03	....	....	....	....	....
	Average	Eagle	35.91	53.61	0.009	10.48	4.46	....	....	....	....	....
520	Everett Hamrick	Lower War Eagle	34.38	51.12	0.006	14.50	5.52	....	....	....	....	....
579	Javis Brooks	Sewell "B"	31.20	57.20	0.004	11.60	0.72	....	....	....	....	....
585	J. E. McFarland	Sewell	30.80	59.80	0.006	9.40	0.75	....	....	....	....	....
586	Javis Brooks	Sewell	30.20	55.80	0.019	14.00	1.80	....	....	....	....	....
587	Javis Brooks	Sewell	30.18	60.88	0.005	8.94	0.72	....	....	....	....	....
590	John E. Roller	Sewell	30.38	59.94	0.003	9.68	1.44	....	....	....	....	....
591	Benedum Brothers	Sewell	31.80	59.20	0.007	9.00	0.97	....	....	....	....	....
597	Holly Lumber Co.	Sewell	27.96	61.63	0.007	10.41	0.99	75.70	4.51	8.22	13,359	14,911

*Not included in average.

Bethlehem Steel Company Table of Coal Analyses, Webster County—Continued.

No. on Map II.	Mine	Horizon	Volatile Matter	Fixed Carbon	Phosphorus	Ash	Sulphur	Carbon	Hydrogen	Oxygen	B. T. U.	B. T. U. Ash Free Coal
600	Holly Lumber Co.	Sewell	32.20	62.44	0.005	5.36	0.75	81.30	5.18	6.86	14,739	15,573
616	Henry Miller	Sewell	29.65	64.95	0.010	5.40	0.80	....	....	....	....	....
617	Bailey Fisher	Sewell	30.20	62.70	0.034	7.10	0.75	....	....	....	....	....
619	Marion Miller	Sewell	30.20	64.40	0.029	5.40	0.77	....	....	....	....	....
633	Reuben Weese	Sewell	32.80	60.60	0.012	6.60	0.74	....	....	....	....	....
638	Pardee & Curtin Lumber Co. (Dyer Run)	Sewell	30.50	64.00	0.012	5.50	0.72	....	....	....	....	....
639	P. B. Weatherhead	Sewell	29.10	61.32	0.014	9.58	0.69	....	....	....	....	....
641	Jonathan Hamrick	Sewell	31.20	63.80	0.017	5.00	0.73	....	....	....	....	....
646	George Gregory	Sewell	30.60	63.98	0.008	5.42	0.82	....	....	....	....	....
653	Pardee & Curtin Lumber Co. (Elza Hamrick)	Sewell	28.94	62.08	0.012	8.98	0.72	76.70	4.67	8.45	13,550	14,887
654	Pardee & Curtin Lumber Co. (Robert Rose)	Sewell	27.60	66.82	0.008	5.58	0.78	....	....	....	....	....
655	W. H. Green	Sewell	31.50	66.02	0.005	2.48	0.54	84.20	5.29	6.74	15,255	15,643
670	Pardee & Curtin Lumber Co.	Sewell	32.00	61.04	0.009	6.96	1.05	....	....	....	....	....
	Average	Sewell	30.41	62.18	0.012	7.41	0.87	79.48	4.91	7.57	14,226	15,253
702	Ezra Clifton	Welch	35.00	59.60	0.009	5.40	1.27	....	....	....	....	....
715	Holly Lumber Co.	Welch	27.06	66.24	0.009	6.70	0.75	81.23	4.96	5.88	14,547	15,591
725	Pardee & Curtin Lumber Co. (A. L. Cummings)	Welch	29.60	65.40	0.017	5.00	0.75	....	....	....	....	....
727	Pardee & Curtin Lumber Co. (Adam J. Hamrick	Welch	29.80	62.72	0.012	7.48	0.64	79.80	4.84	6.56	13,974	15,104
729	Pardee & Curtin Lumber Co. (David Hamrick)	Welch	30.40	60.62	0.030	8.98	0.54	78.10	4.95	6.93	14,933	15,592
731	Pardee & Curtin Lumber Co. (Henry Hamrick)	Welch	30.09	64.65	0.004	5.26	0.56	81.80	5.14	6.55	14,696	15,512
736	Zebulon Bee Heirs	Welch	27.80	63.84	0.005	8.36	0.72	....	....	....	....	....
737	E. H. Morton	Welch	37.80	55.20	0.004	7.00	0.69	....	....	....	....	....
	Average	Welch	30.94	62.29	0.011	6.77	0.74	80.23	4.97	6.48	14,537	15,450
744	D. P. Kessler	Fire Creek	28.40	59.12	0.005	12.48	0.69	....	....	....	....	....
749	J. J. Miller	Fire Creek	29.60	58.48	0.012	11.92	0.72	....	....	....	....	....
	Average	Fire Creek	29.00	58.80	0.0085	12.20	0.70	....	....	....	....	....

Page References to Detailed Descriptions and Sections of Coal Mines Listed in Preceding Table.

No. on Map II.	Sample No.	Coal Bed and Name of Owner.	Location	Page
		Upper Freeport.		
3	45	John Tharp	2 mi. N. W. of Summit Station	281
		Lower Kittanning.		
71	24	J. A. Hinkle	0.4 mi. Eastward from Wheeler	304
105	29	Jackson	2.1 mi. Southward from Prestonia	312
106	30	Floyd Harris	2.3 mi. Southward from Prestonia	312
108	31	Ross F. Stout	0.5 mi. N. W. of Defoe	313
		Upper Mercer.		
143	22	P. B. Bright	2.9 mi. S. E. of Poling	324
		Stockton (Lower Mercer).		
184	26	Tanner & Cutlip	0.5 mi. S. E. of Diana	337
199	8	Lock Gregory	0.4 mi. N. E. of Kovan	340
		Peerless.		
309	20	George H. Miller	1.3 mi. Northward from Breece	378
311	19	John Gregory	On Point Mountain, at Woodzell	378
314	39	Reece & McCabe	Opposite Prestonia	379-80
		Eagle.		
398	21	Mayton Lumber Co.	1.1 mi. S. W. of Hacker Valley	395
428	40	Floyd Siffles	0.8 mi. S. E. of Salisbury	402
433	41	James Lough	1.3 mi. S. W. of Salisbury	402-3
453	37	Davis-Eakin Lumber Co.	1.2 mi. S. E. of Centralia	406
456	32	Davis-Eakin Lumber Co.	2.3 mi. Eastward from Centralia	407
466	38	William McWhorter	1.2 mi. S. of Centralia	409-10
		Lower War Eagle.		
520	23	Everett Hamrick	0.4 mi. N. of Hodam	421
		Sewell "B"		
579	34	Javis Brooks	3.3 mi. East of Centralia	199-200
		Sewell.		
585	44	J. E. McFarland	3.7 mi. Eastward from Centralia	439-40
586	33	Javis Brooks	3.3 mi. Eastward from Centralia	440
587	35	Javis Brooks	1.9 mi. N. W. of Big Run Station	441
590	36	John E. Roller	0.3 mi. S. W. of Clifton Ford	442
591	42	Benedum Brothers	0.5 mi. S. of Clifton Ford	443
597	17	Holly Lumber Co.	1.1 mi. S. W. of Skelt P. O.	445
600	18	Holly Lumber Co.	1.9 mi. East of Skelt P. O.	446
616	2	Henry Miller	2.1 mi. Eastward from Webster Springs	451
617	7	Bailey Fisher	2.3 mi. N. E. of Webster Springs	451
619	1	Marion Miller	2.4 mi. N. E. of Webster Springs	452
633	4	Reuben Weese	1.5 mi. S. E. of Webster Springs	455
638	51	Pardee & Curtin Lumber Co. (Dyer Run)	2.8 mi. S. E. of Webster Springs	456
639	10	P. B. Weatherhead	1.0 mi. S. W. of Ralph	456-7
641	3	Jonathan Hamrick	0.7 mi. N. E. of Ralph	457
646	5	George Gregory	2.6 mi. S. E. of Ralph	458
653	15	Pardee & Curtin Lumber Co. (Elza Hamrick)	2.5 mi. N. E. of Bergoo	460
654	12	Pardee & Curtin Lumber Co. (Robert Rose)	4.0 mi. S. E. of Bergoo	460-1
655	13	W. H. Green	5.1 mi. Eastward from Bergoo	461
670	50	Pardee & Curtin Lumber Co.	3.0 mi. Eastward from Bolair	465
		Welch.		
702	43	Ezra Clifton	0.4 mi. Southward from Clifton Ford	476
715	9	Holly Lumber Co.	1.7 mi. N. E. of Breece	479
725	6	Pardee & Curtin Lumber Co. (A. L. Cummings)	0.9 mi. S. E. of Bergoo	482
727	11	Pardee & Curtin Lumber Co. (Adam J. Hamrick)	1.4 mi. S. E. from Bergoo	482
729	14	Pardee & Curtin Lumber Co. (David Hamrick)	1.6 mi. Eastward from Bergoo	483
731	16	Pardee & Curtin Lumber Co. (Henry Hamrick)	2.6 mi. N. E. of Bergoo	483-4
736	49	Zebulon Bee Heirs	0.7 mi. S. E. of Bolair	485
737	47	E. H. Morton	1.2 mi. N. E. of Bolair	485
		Fire Creek.		
744	46	D. P. Kessler	1.8 mi. S. W. of Webster Springs	490
749	48	J. J. Miller	0.4 mi. N. E. of Bolair	491

FUSIBILITY OF ASH IN WEST VIRGINIA COALS.

The following very interesting paper, prepared by Walter A. Selvig, of the United States Bureau of Mines, and furnished the Survey by Dr. Van H. Manning, Director of the Bureau, gives a series of tests on the "Fusibility of Coal Ash from West Virginia Coals." While the tests recorded in this paper were made from mines scattered throughout the active coal area of the State, and are therefore of general interest, they have a close bearing on Webster County. By reference to previous pages in this Report, it will be noted that the coals of Webster belong in the Allegheny and Pottsville Series, where high averages of fusibility were obtained by Mr. Selvig, the best results having been obtained in the New River Group of the latter series. These New River coals crop throughout the southern half of Webster and it may therefore be assumed that the county contains vast quantities of steaming coal that will give almost total absence of clinker.

In the classification of coals attention is called to the fact that a certain confusion of names occurs. The Coalburg Coal is listed as identical with the Buffalo Creek bed, while the latter seam belongs below the Coalburg. The Winifrede Coal is correlated with the "Black Band" seam, while, in fact, the "Black Band" seam is identical with the Hernshaw Coal which comes lower in the group than the Winifrede. The name "Island Creek" is included under the No. 2 Gas Coal, but the true "Island Creek" Coal is identical with the Cedar Grove, the trade name of "Island Creek" having been used for this seam by the coal operators of Logan County.

DEPARTMENT OF THE INTERIOR
Bureau of Mines
Washington
Office of the Director

September 10, 1918.

Dr. I. C. White, State Geologist,
West Virginia Geological Survey,
Morgantown, West Virginia.

My dear Dr. White:

I am sending you herewith a copy of a paper by Walter A. Selvig on "Fusibility of Coal Ash from West Virginia Coals." It is the intention of the Bureau of Mines at a later date to make similar investigations in other coal fields of the country and prepare papers, all of them to be printed in one bulletin. As there has been a considerable demand for such information from large consumers of coal, not only in connection with the clinkering of coal when fired under boilers but also in connection with industries being developed at the present time, it was thought that this paper should be given out in advance of the printing of the bulletin which will take several months on account of the present over-crowded condition of the Government Printing Office. If you find the paper of sufficient interest to your State and also some way in which it may be printed and distributed, you are at entire liberty to use this manuscript.

Copies of this paper have been sent to Power, New York, Chemical and Metallurgical Engineering, New York, and Journal of Electricity, Power and Gas, San Francisco, Cal.

Cordially yours,

VAN H. MANNING,
Director.

FUSIBILITY OF COAL ASH FROM WEST VIRGINIA COALS

By

WALTER A. SELVIG
of the U. S. Bureau of Mines.

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INTRODUCTION.

Information concerning the fusibility of coal ash has become of considerable interest to the consumer of coal during the last few years, principally in connection with the troublesome formation of clinker which results from the melting of the ash constituents of the coal when subjected to heat.

The growing interest for such data has led the Bureau of Mines to make a general survey of the "fusing" or "softening" temperatures of the ash from well-known American coals. It is hoped that this information when used together with the large number of coal analyses made available by the publications of the Bureau of Mines[1] will be of help to the consumer of coal in comparing the different coals and in the selection of the coal best adapted for his purpose.

This paper gives the results obtained for West Virginia coals, among which are found some of the purest fuels of the country.

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[1]Lord, N. W., and others, Analyses of coals in the United States, with descriptions of mine and field samples collected between July 1, 1904, and June 30, 1910; Bull. 22, Bureau of Mines, 1913, 1,200 pp. (In two parts).

Fieldner, A. C., and others, Analyses of mine and car samples collected in the fiscal years 1911 to 1913; Bull. 85, Bureau of Mines, 1914, 444 pp.

Fieldner, A. C., and others, Analyses of mine and car samples collected in the fiscal years 1913 to 1916; Bull. 123, Bureau of Mines, 1917, 456 pp.

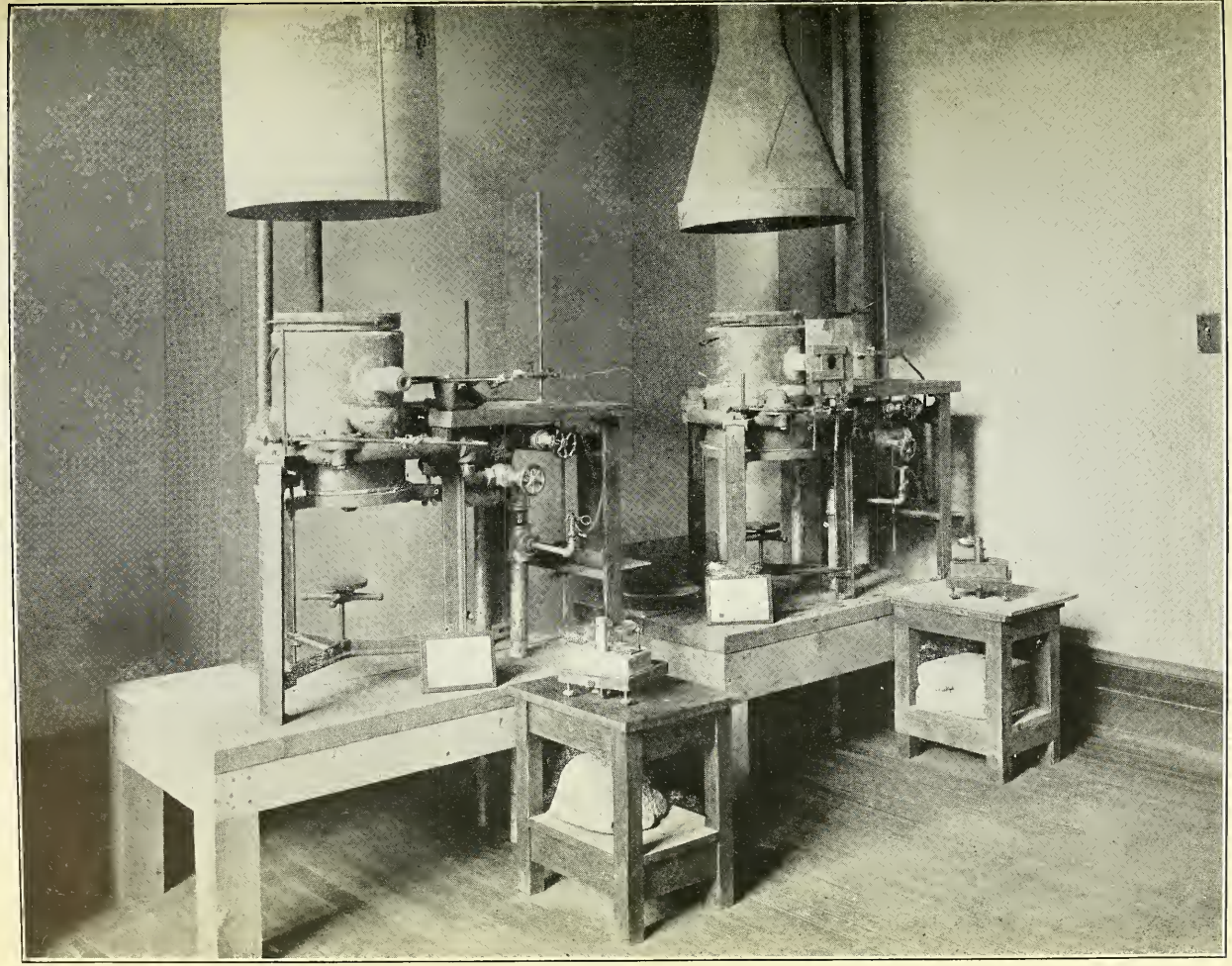

PLATE XXXII.—No. 3 Melter's Furnace and Accessories.

DESCRIPTION OF METHOD FOR DETERMINING FUSIBILITY OF COAL ASH.

The method employed for the fusibility tests was the standard gas furnace method[2] of the Bureau. In order to better interpret the results given in the table of fusibility this method is briefly summarized here.

Preparation of Cones.—The coal samples are ground to 60 mesh, with crusher, rolls and ball mill. This 60-mesh material is then placed in shallow fire clay roasting dishes and completely ashed in a muffle furnace at a temperature of 800° C. to 900° C.

The resulting ash is ground in an agate mortar to pass a 200-mesh sieve. To make sure that the coal has been completely ashed, the ash after grinding is placed in fused silica capsules and ignited at 800° C. for two hours, a current of oxygen gas passing through the furnace during the ignition period. This ignition is made to insure complete and uniform oxidation of the ash.

A portion of the ash is transferred to an agate mortar, moistened with a 10 per cent. dextrin solution and worked into a plastic mass with a spatula. The ash is then molded into solid triangular pyramids, ¾ inch high, and ¼ inch wide at the side of the base. These cones are removed from the brass cone mold, dried, and mounted in a vertical position in a refractory base made up of a mixture of two parts of kaolin to one part of calcined alumina. Usually five cones are mounted in the same base. The base with the cones is dried carefully over the hot plate until all water is driven off, then the dextrin is burned out of the cones by igniting the mounted cones in a muffle furnace at a dull red heat, after which the cones are ready for use.

Description of Operation of Furnace.—The furnace used was the No. 3 melter's furnace (Plate XXXII) of the American Gas Furnace Co., natural gas and air pressure of

[2]For detailed description of this method and discussion of the influence of various factors on the fusibility of coal ash see Fieldner, A. C., Hall, A. E., and Feild, A. L., The fusibility of coal ash; Bull. 129, Bureau of Mines, 1918, pp. 146.

from 2 to 3 pounds to the square inch being used. The cones supported by a suitable mounting are placed within a covered fire clay crucible in the furnace. A two-inch hole is drilled through the furnace jacket and fire clay crucible for observation purposes, a fused silica tube carrying a thin glass window being placed in the observation hole. At right angles to the observation hole a ¼-inch hole is drilled through the furnace and crucible. Through this hole a platinum-platinum rhodium thermo-couple, protected by a glazed porcelain tube, is inserted. By proper adjustment of the gas and air, a reducing atmosphere is maintained within the furnace, this being accomplished by using the minimum amount of air necessary to attain the desired temperature. Under these conditions, the iron in the ash is reduced to the ferrous state, which condition gives the lowest melting points and therefore gives the lowest temperature at which clinkering may result. The temperature is gradually increased to 800° C. when the rate is slowed down to not less than 5° C. nor more than 10°C. per minute, this rate being maintained until the end of the test when a maximum temperature of 1500° C. or 2732° F. is attained.

In some instances with coal ash of an especially refractory nature the cones which did not fuse at the highest temperature attained in the gas furnace, were further heated in a molydenum wire resistance furnace[3] in an atmosphere of hydrogen gas. Under these conditions temperatures as high as 3010° F., and in some instances slightly higher were attained. However, a coal whose ash fuses above 2730° F., should give very little trouble due to clinker formation.

Temperature Readings Taken.—The temperature values given in the table represent two temperature readings, as follows:

[3]Fieldner, A. C., and Feild, A. L., "A new method and furnace for the determination of the softening temperature of coal ash under fuel-bed conditions," the Journal of Industrial and Engineering Chemistry, Vol. 7, No. 10, 1915, pp. 829-835.

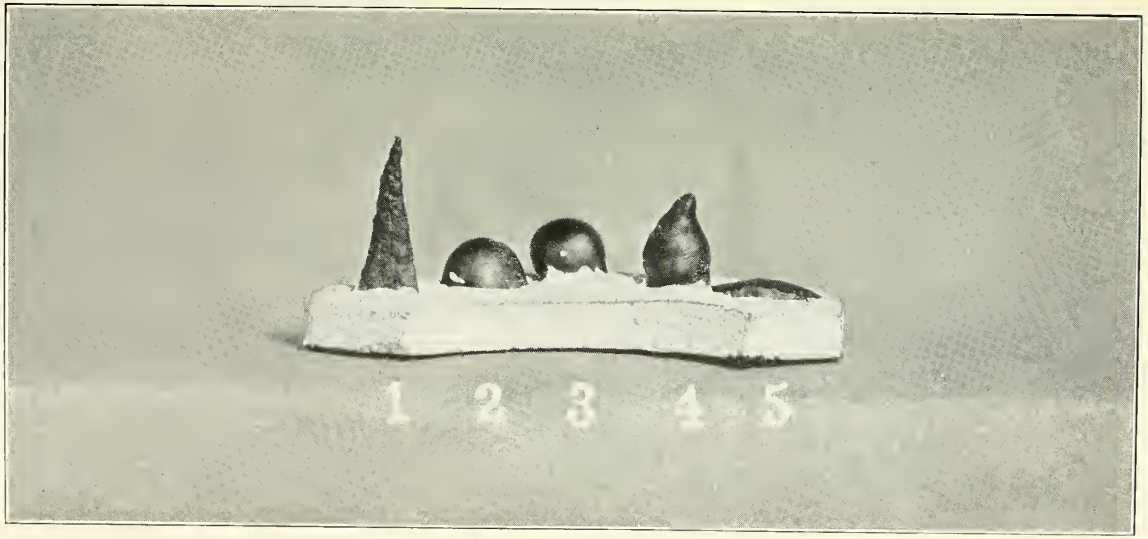

PLATE XXXIII.—Typical forms of cones fused in the No. 3 Melter's Furnace.

(1) **The Initial deformation temperature:**

The temperature at which the first rounding or bending of the apex of the cone takes place as shown in cone 1 of Plate XXXIII.

(2) **The softening temperature:**

The temperature at which the cone has fused down to a spherical lump as shown in cones 2 and 3 of Plate XXXIII.

Only the softening temperature is reported, together with the softening interval, which is the difference in degrees between the softening temperature and the initial deformation temperature.

INTERPRETATION OF FUSIBILITY TABLE.

Arrangement of Coal Beds.—According to the West Virginia Geological Survey, there are 102 known coal beds in West Virginia of which 52 are minable. The table contains samples representing nearly one-half of these minable beds, the beds listed being among the most important in the State.

The various beds are arranged according to their geological succession, from information supplied by courtesy of the West Virginia Geological Survey together with information taken from the Keystone Coal Catalog[4], the uppermost coal beds being listed first. The succession of coal beds listed is as follows:

Monongahela Series:
- Sewickley (Mapletown) bed.
- Redstone bed.
- Pittsburgh bed.

Conemaugh Series:
- Mahoning bed.

Allegheny Series:
- Upper Freeport bed.
- Lower Freeport bed.
- Middle Kittanning bed.
- Lower Kittanning (No. 5 Block) bed.

[4]"The Coal Catalog combined with coal field directory," for the year 1918, Keystone Consolidated Publishing Co., Pittsburgh, Pa., pp. 579-588.

Pottsville Series:
(a) Kanawha Group:
Coalburg (Buffalo Creek) bed.
Winifrede (Black Band) bed.
Cedar Grove (Thacker) bed.
No. 2 Gas (Campbell Creek, Island Creek, Upper War Eagle) bed.
Eagle (No. 1 Gas, Middle War Eagle) bed.
(b) New River Group:
Sewell (Davy) bed.
Welch (Tug River) bed.
Beckley (War Creek) bed.
Fire Creek (Quinnimont) bed.
(c) Pocahontas Group:
Pocahontas No. 6 bed.
Pocahontas No. 5 bed.
Pocahontas No. 4 bed.
Pocahontas No. 3 bed.

It will be noted that the uppermost series given is the Monongahela Series, there being no samples representing the overlying Dunkard Series which top out the highest beds in the Appalachian field; however, these coals are of very little commercial importance at the present time.

Under each bed the arrangement is alphabetical according to county, town, and mine. The various beds are known by different names in certain districts so there is given in parentheses, following the most common name, other names by which the same bed is known.

Values tabulated.—The results given for each mine show the lowest softening temperature, the highest softening temperature and the average for the mine. The softening interval is tabulated in the same manner. In addition to these values the per cent. ash and sulphur, on the dry coal basis, is given.

It will be noted in the table that certain values are preceded by a plus sign (+), an asterisk (*), or both. This would not be necessary, provided the cones all reached their softening temperatures at the highest temperature attained during the test; however, in a number of tests when dealing with coal ash of an especially refractory nature, there were one or more samples which did not fuse to completion. A plus sign (+) before a given value denotes that the true

value lies beyond that given; an asterisk (*) placed before a given value denotes that the given value is the one actually observed during the test or the average of the observed values. However, one or more of the cones did not fuse to completion, therefore this given value might be either greater or less than that indicated value provided temperatures high enough to reach the softening temperatures of all of the samples were attained.

DISCUSSION OF RESULTS.

Average Values Tabulated.—The average values given for each bed provide a means of comparison of the different coals; however, of course, the average values are averages of the mines which are listed under each bed, consequently the greater the number of mines sampled, the more representative the values are of the bed. In some instances only a few mines are listed under the bed. In these cases the average values given are only representative of the mines sampled, and do not constitute a fair average of the bed. Beds such as the Pittsburgh, Sewell, Beckley, and Pocahontas No. 3, from which a large number of samples have been tested and the softening temperature values for the various mines are uniform, the average values given may be taken as representative of the bed.

It will be noted that the softening interval values given under columns 6, 7, and 8 vary considerably. These values as already explained give the number of degrees interval between the temperature at which the tip of the cone fuses or bends and the temperature at which the cone has fused down to a spherical lump, which temperature is recorded as the softening temperature. The point at which the tip first fuses or bends is rather difficult to obtain exactly on account of the phenomena of warping and shrinking of the cones which sometimes result when the cones are subjected to heat. The softening interval is interesting mainly as a study of the viscosity of the melting ash. The softening temperature values as given in columns 3, 4, and 5 are the values which are used in comparing the different coals. This is the most definite and easy point to check in the tests.

Discussion of Coal Beds Tested.—Under the Monongahela Series, the Sewickley, Redstone, and Pittsburgh beds are listed. Not sufficient mines are represented to give representative average values for the Sewickley and Redstone beds. The Pittsburgh bed, which is the most important coal bed in the northern part of West Virginia and contains one of the most valuable fuels of the country, is fairly well represented. This bed varies considerably as to sulphur content in different regions. It will be noted, however, that the softening temperatures as given are fairly uniform, but are lower than many of the other beds listed.

The mines listed under the Conemaugh Series are all coal banks from the Mahoning bed which is of no commercial value but is mined for local use. The average softening temperature from these coal banks is practically the same as that of the Pittsburgh bed.

In the Allegheny Series, the Lower Kittanning or No. 5 Block bed is a very important coal. This bed varies from a high volatile coal in the southwestern half of the State, through an ordinary bituminous type of coal in Randolph and Barbour Counties to a semi-bituminous coal in the North Potomac basin.[5] As might be expected from a coal varying so much in composition the values given for this bed vary over a wide range, but no doubt the mines listed give representative values for their immediate districts.

The coals listed under the Kanawha Group of the Pottsville Series are coals giving ash having a uniformly high fusing temperature. The No. 2 Gas is the most important and valuable bed of this group and is widely known commercially. This bed as well as the others of this group contains coals giving ash having a high fusibility.

The New River Group of the Pottsville Series contains some of the best known coals of the country, coals having a low ash and sulphur content, also giving an ash with a high fusing temperature.

[5]West Virginia Geological Survey, Bull. 2, "Levels and Coal Analyses," 1911, p. 296.

The Sewell bed, which is the most important of the New River Group, is very well represented in the table. The mines tested give a very uniform fusibility of ash value and the average value for the bed is good. This coal, which is semi-bituminous in character, is one of the famous steam producing coals of the country and is the most extensively developed of the New River coals.

The Beckley bed, which is a very important member of the semi-bituminous coals of the New River Group, shows some remarkably high fusibility values. The ash from this coal is of a specially refractory nature and this bed gives fusibility values higher than any other of the beds of West Virginia that were tested. This coal should prove of interest to consumers demanding a high-grade coal giving an ash of an exceptionally high fusibility.

The last group listed and the oldest and lowermost of the West Virginia coals is the Pocahontas Group which contains the famous Pocahontas No. 3 bed of Mercer and McDowell Counties. This seam produces the well-known Pocahontas semi-bituminous coal which is one of the purest coals of the country and is being used extensively as a steaming and coking coal. The average values given for this bed represent 246 samples, so should be very representative of this celebrated coal. As is seen, the figures representing the different mines are very uniform. Although the average softening temperature of this bed is not as high as some of the others, especially the Beckley bed, it is uniformly high and little trouble should be experienced from clinkering.

SUMMARY.

A table has been prepared giving data concerning the fusibility of coal ash from the principal coal beds of West Virginia, together with a brief description of the method employed in making the tests and a discussion of the results obtained.

ACKNOWLEDGMENTS.

Grateful acknowledgment is made to A. C. Fieldner, Chemist, formerly of the Pittsburgh Station of the Bureau of Mines, under whose supervision most of the tests were made.

Many of the tests were made by Messrs. A. E. Hall, V. C. Allison, C. R. Locke, C. S. Purcell, W. C. Ratliff, and O. C. Brown, all of the chemical laboratory of the Bureau of Mines.

* * * *

Chemical Laboratory, U. S. Bureau of Mines,
Pittsburgh, Pa.

Table of Softening Temperatures of Coal Ash from West Virginia Coals.

Locality, Bed, etc.			Number of Samples from mine	Softening Temperature °F.			Softening Interval °F.			Average analysis of dry coal percentage of	
				Lowest	Highest	Average	Lowest	Highest	Average	Ash	Sulphur
1			2	3	4	5	6	7	8	9	10
MONONGAHELA SERIES											
Sewickley, (Mapletown) Bed											
County	*Town.*	*Mine.*									
Marion	Montana Station	Parker Run	5	2050	2120	2080	50	110	80	9.61	3.99
Redstone Bed.											
Harrison	Lost Creek	Calif	4	2000	2140	2060	70	220	120	8.08	2.24
Harrison	Lost Creek	Righter No. 1	5	2030	2370	2180	70	360	170	6.07	1.66
Average of Redstone Bed			9			2120			150	6.96	1.92
Pittsburgh Bed.											
Braxton	Braxton	Braxton	1			2090			60	8.93	3.50
Brooke	Colliers	Lewis Finley No. 1	2	2070	2600	2340	110	180	150	6.28	1.75
Marion	Chiefton	Consolidation No. 47	6	2040	2170	2090	30	200	100	7.41	2.97
Marion	Fairmont	Consolidation No. 38	3	2100	2150	2130	100	190	140	6.97	2.29
Marion	Farmington	Consolidation No. 87	4	2010	2330	2230	30	70	50	6.61	1.23
Marion	Hutchinson	Consolidation No. 84	6	2010	2310	2230	10	330	120	7.12	1.98
Marion	Monongah	Consolidation No. 43	6	2170	2350	2270	30	120	70	6.27	1.07
Marion	Monongah	Consolidation No. 63	6	2200	2330	2270	40	100	60	5.84	1.07
Marion	Watson	Consolidation No. 26	5	2000	2260	2110	10	80	40	6.65	1.87
Marion	Worthington	Consolidation No. 86	4	2240	2410	2340	20	60	40	6.15	.80
Marion	Worthington	Hutchinson	3	2070	2170	2130	40	120	80	8.70	2.25
Marshall	Benwood	Hitchman	6	1940	2000	1970	50	80	60	8.33	4.65
Marshall	Moundsville	Mound	2	2020	2130	2080	120	230	180	12.44	6.09
Marshall	Moundsville	Panama	2	2070	2090	2080	110	140	130	7.29	3.33
Putnam	Black Betsey	Black Betsey No. 3	7	1930	2370	2140	70	250	130	7.39	1.94
Average of Pittsburgh Bed			63			2170			90	7.20	2.24
CONEMAUGH SERIES.											
Mahoning Bed.											
Hancock	Chester	Allison Coal Bank	1			2130			90	694	1.88
Hancock	New Cumberland	Martin Coal Bank	1			2300			260	4.13	1.46
Hancock	New Cumberland	McNeil-Harrin Coal Bank	1			2140			120	6.13	2.15
Hancock	New Cumberland	Wern's Coal Bank	1			2080			40	5.28	2.05
Average of Mahoning Bed			4			2160			130	5.62	1.89

NOTE: A plus sign (+) placed before a given value denotes that the true value is above that indicated.
An asterisk (*) placed before a given value denotes that the val ues given are those actually observed, however, a temperature high enough to fuse all of the samples was not attained, therefore the true value might be either greater or less than the indicated value.

Table of Softening Temperatures of Coal Ash from West Virginia Coals—Continued.

Locality, Bed, etc.			Number of Samples from mine	Softening Temperature °F.			Softening Interval °F.			Average analysis of dry coal percentage of	
				Lowest	Highest	Average	Lowest	Highest	Average	Ash	Sulphur
1			2	3	4	5	6	7	8	9	10
ALLEGHENY SERIES.											
County	Town	Mine									
	Upper Freeport Bed.										
.....	Henry	Henry or No. 22	1	.....	.....	2190	.....	.....	220	6.17	1.97
	Lower Freeport Bed.										
e	Steubenville, O. (opp.)	LaBelle	1	.....	.....	2100	.....	.....	130	7.12	1.98
ck	Chester	Sprout's Coal Bank	1	.....	.....	2070	.....	.....	90	12.55	4.29
	rage of Lower Freeport Bed		2	.....	.....	2090	.....	.....	110	9.84	3.14
	Middle Kittanning Bed.										
ck	Chester	Line Island Coal Bank	1	.....	.....	2110	.....	.....	110	10.93	4.06
	Lower Kittanning, (No. 5 Block) Bed.										
.....	Widen	Rich Run	12	2430	+3070	+2730	*80	*280	+150	7.19	.94
ck	Chester	Jones Coal Bank	1	.....	.....	2150	.....	.....	90	6.15	4.64
ck	New Cumberland	Crescent	1	.....	.....	2280	.....	.....	220	13.65	9.20
wha	Putney	Putney No. 1	5	2250	+3010	+2780	*60	*250	*+100	.....	.....
on	Corinth	Wills No. 3	1	.....	.....	2080	.....	.....	120	9.55	3.15
on	Kempton	Kempton or No. 42	1	.....	.....	2430	.....	.....	310	5.55	.82
r	Coketon	Coketon No. 36	1	.....	.....	3010	.....	.....	120	8.76	.90
	age of Lower Kittanning, (No. 5 Block) Bed		22	.....	.....	+2660	.....	.....	+140	7.64	1.76
POTTSVILLE SERIES—KANAWHA GROUP											
	Coalburg, (Buffalo Creek) Bed.										
	Ward	Kelly's Creek Colliery Co. No. 3	6	2790	+3010	+2950	*30	*130	*80	8.75	.75
wha	Chattaroy	Howard	1	.....	.....	3030	.....	.....	120	9.12	.84
	age Coalburg, (Buffalo Creek) Bed		7	.....	.....	+2960	.....	.....	80	8.80	.76
	Winifrede Bed.										
.....	Chattaroy	Buffalo	2	3010	3010	3010	110	160	140	10.27	.96
.....	Williamson	Sternberger	1	.....	.....	2850	.....	.....	250	8.10	.68
.....	Williamson	Winifrede	1	.....	.....	3000	.....	.....	150	5.11	.71
	age of Winifrede Bed		4	.....	.....	2970	.....	.....	170	8.44	.83

Table of Softening Temperatures of Coal Ash from West Virginia Coals—Continued.

Locality, Bed, etc.			Number of Samples from mine	Softening Temperature °F.			Softening Interval °F.			Average analysis of dry coal percentage of	
				Lowest	Highest	Average	Lowest	Highest	Average	Ash	Sulphur
POTTSVILLE SERIES. KANAWHA GROUP.											
1			2	3	4	5	6	7	8	9	10
County	Town	Mine									
Cedar Grove (Thacker) Bed.											
Logan	Accoville	Island Creek	6	2520	+3010	+2690	80	*130	+100	5.82	1.28
Logan	Craneco	Lorado No. 1	5	2470	+3010	+2760	20	+160	+110	5.59	.74
Logan	Omar	Main Island Creek No. 5	5	2390	2900	2600	40	80	140	5.62	.88
Mingo	Chattaroy	Buffalo	1			2320			200	6.05	2.10
Mingo	Matewan	Red Jacket, Jr.	1			2600			220	3.51	.68
Mingo	Thacker	Thacker No. 3	1			2620			210	7.16	1.18
Mingo	Thacker	Thacker No. 5	1			2490			140	6.24	1.04
Mingo	Thacker	Thacker No. 9	2	2410	2460	2440	50	460	260	6.35	.73
Mingo	Thacker	Thacker No. 11	1			2520			420	5.01	1.49
Mingo	Williamson	Winifrede	1			2390			260	8.28	1.93
Average of Cedar Grove, (Thacker) Bed			24			+2610			+160	5.83	1.07
No. 2 Gas, (Campbell Creek, Island Creek, Upper War Eagle) Bed.											
Fayette	Longacre	Sunday Creek No. 114	6	2100	2520	2360	70	190	130	5.70	1.09
Fayette	Marting	No. 1	8	2850	+3010	+2950	70	*120	+90	6.32	.92
Fayette	Page	Austed	1			2430			90	6.61	1.81
Logan	Accoville	Big Eagle	7	2730	2960	2830	80	270	150	6.08	.65
Logan	Darling	Darling No. 1	4	2850	2960	2940	70	140	110	5.10	.71
Mingo	Merrimac	White Star	1			2540			140	3.78	.66
Average No. 2 Gas, (Campbell Creek, Island Creek, Upper War Eagle) Bed			27			+2750			+120	5.86	.88
Eagle, (No. 1 Gas, Middle War Eagle) Bed.											
Fayette	Boomer	No. 2 North	3	2900	+3010	+2940	50	*230	+150	4.40	.77
NEW RIVER GROUP *Sewell, (Davy) Bed.*											
Fayette	Caperton	Sewell	5	2620	+3000	+2860	90	*360	+220	2.44	.56
Fayette	Dun Loop	Dun Loop No. 2	4	2390	2980	2620	150	210	180	2.64	.55
Fayette	Elverton	Elverton	4	2350	2650	2500	60	350	180	2.44	.59
Fayette	Hawks Nest	Mill Creek	4	2370	2730	2510	20	130	90	4.01	.63

Table of Softening Temperatures of Coal Ash from West Virginia Coals—Continued.

Locality, Bed, etc.			Number of Samples from mine	Softening Temperature °F.			Softening Interval °F.			Average analysis of dry coal percentage of	
				Lowest	Highest	Average	Lowest	Highest	Average	Ash	Sulphur
POTTSVILLE SERIES NEW RIVER GROUP.											
1			2	3	4	5	6	7	8	9	10
County	Town	Mine									
	Sewell (Davy) Bed										
Fayette	Kay Moor	Kay Moor No. 1	5	2310	2930	2690	90	270	210	3.17	.56
Fayette	Kay Moor	Kay Moor No. 2	3	2430	2640	2530	80	140	110	3.57	.54
Fayette	Minden	Minden No. 2	3	2280	2640	2450	100	280	200	3.23	.65
Fayette	Minden	Minden No. 3	1			2600			210	2.86	.56
Fayette	Minden	Minden No. 4	3	2270	2710	2550	100	230	160	2.57	.43
Fayette	Minden	Minden No. 5	4	2080	2620	2340	30	220	110	3.13	.88
Fayette	Minden	Rock Lick No. 4	3	2370	2620	2520	50	130	100	2.43	.45
Fayette	South Nuttall	Brown	4	2580	2830	2720	30	140	70	2.62	.57
Fayette	Sun	Sun No. 1	5	2070	2550	2250	90	290	180	6.14	1.69
Greenbrier	Richwood	Spruce Knob	1			2960			430	6.04	.65
McDowell	Big Sandy	Big Sandy	2	2290	2370	2330	70	170	120	3.60	.53
McDowell	Coalwood	Nora or No. 3	4	2350	2490	2420	120	230	170	2.95	.74
McDowell	Coalwood	Thelma or No. 6	7	2300	2650	2440	80	300	200	4.32	1.03
McDowell	Davy	Blackstone	1			2430			90	3.48	.54
McDowell	Davy	Cletus	1			2430			60	2.67	.51
McDowell	Davy	Helena	1			2460			80	3.18	.58
McDowell	Marytown	Marytown	2	2520	2670	2600	80	110	100	8.95	.75
McDowell	Roderfield	Davy or Pocahontas No. 2	3	2430	2980	2770	90	250	150	6.43	.89
McDowell	Twin Branch	J. B. B. No. 1	1			2440			170	3.10	.55
McDowell	Twin Branch	J. B. B. No. 2	1			3010			360	4.40	.55
McDowell	Twin Branch	J. B. B. No. 3	1			2540			140	5.27	.76
McDowell	Twin Branch	J. B. B. No. 4	1			2550			210	5.20	.85
McDowell	Twin Branch	J. B. B. No. 5	2	2450	2550	2500	220	360	290	3.00	.55
McDowell	Twin Branch	Maher or No. 4	9	2500	2730	2620	40	150	100	4.41	.71
Raleigh	Cranberry	Cranberry	2	2460	2480	2470	130	150	140		
Raleigh	Oswald	Oswald No. 3	3	2190	2590	2380	260	270	260	4.07	.80
Raleigh	Tamroy	Tamroy	3	2540	+3010	+2850	*190	*190	*190	1.97	.50
Randolph	Mill Creek	Tolbert and Spiker	1			+3010				11.43	.52
Randolph	Spruce	Hopkins	1			+2730				13.85	.99
Average Sewell (Davy) Bed			95			+2560			+160	3.93	.72

Table of Softening Temperatures of Coal Ash from West Virginia Coals—Continued.

Locality, Bed, etc.			Number of Samples from mine	Softening Temperature °F.			Softening Interval °F.			Average analysis of dry coal percentage of	
				Lowest	Highest	Average	Lowest	Highest	Average	Ash	Sulphur
			2	3	4	5	6	7	8	9	10
POTTSVILLE SERIES											
NEW RIVER GROUP											
County	*Town*	*Mine*									
	Welch, (Tug River) Bed.										
McDowell	Hemphill	Welch	5	2720	2970	2840	90	270	180	7.41	.62
	Beckley, (War Creek) Bed.										
McDowell	Roderfield	Davy Pocahontas No. 1	3	2520	2960	2720	60	140	100	11.31	1.82
McDowell	Susana Station	Yukon Pocahontas	4	2400	2620	2450	40	90	70	8.50	.57
McDowell	War	John's Branch	4	2650	+3010	+2860	110	+160	+130	8.99	.63
McDowell	War	War Creek	3	2730	2750	2740	40	80	50	8.62	.72
Raleigh	Affinity	Affinity	7	2690	+3090	+3000	40	*70	*60	4.19	.56
Raleigh	Big Stick	Big Stick	11	2700	+3010	+2900	10	220	80	4.36	.53
Raleigh	Eccles	Eccles No. 5	5	2550	+3010	+2920			*200	6.44	.78
Raleigh	McAlpin	McAlpin	2	2730	+3010	+2870	*240	*240	*240	2.65	.65
Raleigh	McQuade Station	Blue Jay	3	2730	+3020	+2850	*160	*180	*170	4.38	.75
Raleigh	Raleigh	Raleigh No. 1	2	2540	+3010	+2780	+110	+330	+220	3.49	.67
Raleigh	Raleigh	Raleigh No. 3	5	2620	2900	2720	70	170	130	3.82	.74
Raleigh	Slab Fork	Slab Fork No. 1	1			2580			210	2.87	.61
Raleigh	Slab Fork	Slab Fork No. 2	8	2480	+3010	+2740	*150	*270	*190	3.69	.50
Raleigh	Slab Fork	Slab Fork No. 3	7	2370	+3010	+2740	*120	*260	*190	4.03	.54
Raleigh	Slab Fork	Slab Fork No. 4	1			2960			230	2.39	.55
Raleigh	Slab Fork	Slab Fork No. 5	8	2520	+3010	+2760	*160	*320	*230	3.49	.50
Raleigh	Tams Station	Tams	3	3010	+3010	+3010	*220	*220	*220	4.67	.55
Raleigh	Winding Gulf	Lynwin	7	2620	+3010	+2860	*100	*+230	*+160	4.27	.71
Raleigh	Winding Gulf	Winding Gulf No. 1	3	2730	+3020	+2920	140	*160	+150	3.05	.47
Raleigh	Winding Gulf	Winding Gulf No. 2	2	2960	2990	2980	140	270	210	2.78	.51
Raleigh	Wood Bay	McAlpin No. 1	8	2560	+3010	+2850	40	320	+140	3.66	.60
Wyoming	Alpoca	Alpha	4	2120	2540	2360	210	340	270	4.45	1.05
Average of Beckley, (War Creek) Bed			101			+2800			+150	4.76	.65
	Fire Creek, (Quinnimont) Bed.										
Fayette	Layland	Layland No. 3	11	2480	2850	2660	*30	*280	*130	6.99	.87
Fayette	Thayer	Ephraims Creek (Buffalo)	3	2180	2580	2270	50	130	110	6.90	.87
Fayette	Thurmond	Rock Lick No. 2	3.	2210	2730	2390	100	170	140	4.90	.68
Average Fire Creek, (Quinnimont) Bed			17			2540			130	6.60	.84

Table of Softening Temperatures of Coal Ash from West Virginia Coals—Continued.

Locality, Bed, etc.			Number of Samples from mine	Softening Temperature °F.			Softening Interval °F			Average analysis of dry coal percentage of	
				Lowest	Highest	Average	Lowest	Highest	Average	Ash	Sulphur
POTTSVILLE SERIES POCAHONTAS GROUP.											
1			2	3	4	5	6	7	8	9	10
	Pocahontas No. 6 Bed.										
rcer	Simmons	Buckeye No. 2	6	2290	2760	2400	60	190	120	2.88	.70
	Pocahontas No. 5 Bed.										
Dowell	Faraday	Crockett Pressliz	1			2350			60	3.09	.55
Dowell	Lex	Central West	2	2730	+3010	+2870	+110	+130	+120	780	.65
verage Pocahontas No. 5 Bed			3			+2700			100	6.23	.62
	Pocahontas No. 4, (Thin Vein Pocahontas) Bed.										
Dowell	Big Four	Cirrus No. 2	1			2770			220	3.85	.57
Dowell	Coalwood	No. 1	5	2100	2220	2170	50	120	70	5.29	.67
Dowell	Coalwood	Olga	3	2030	2140	2080	50	100	80	6.43	.77
Dowell	Huger	Middle States	6	2190	2730	2390	60	180	100	6.04	.63
Dowell	Vivian	Carswell Shaft	3	2850	+3010	+2920	60	120	+80	6.81	.61
Dowell	Welch	Oregon No. 2	2	+2730	+2730	+2730				7.52	.53
Dowell	Welch	Oregon No. 3	3	+2730	+3010	+2900	*190	*190	*190	7.92	.63
verage Pocahontas No. 4, (Thin Vein Pocahontas) Bed			23			+2480			+110	6.31	.64
	Pocahontas No. 3, (Pocahontas Thick Vein) Bed.										
Dowell	Algoma	Piney	7	2180	2300	2240	30	100	50	4.79	.56
Dowell	Arlington	Arlington	3	2450	2680	2520	120	360	240	3.80	.43
Dowell	Bear Wallow	Roanoke	4	2190	2330	2270	140	230	210	6.38	.44
Dowell	Berwind	Berwind No. 1	3	2280	2450	2360	200	320	260	5.17	.90
Dowell	Berwind	Berwind No. 2	3	2170	2340	2250	70	190	140	7.54	.87
Dowell	Berwind	Berwind No. 3	3	2380	2510	2460	140	350	210	5.90	.88
Dowell	Berwind	Berwind No. 4	2	2300	2340	2320	160	260	210	5.30	.95
Dowell	Big Four	Cirrus No. 2	4	2200	2340	2290	60	100	80	4.56	.63
Dowell	Cooper	Tug River	4	2320	2690	2480	90	380	200	2.90	.46
Dowell	Crystal	Crystal No. 1	2	2590	2610	2600	120	180	150	4.30	.53
Dowell	Crystal	Crystal No. 2	4	2410	2520	2480	150	330	270	4.50	.64
Dowell	Crystal	Godfrey	3	2370	2580	2490	130	180	150	3.88	.73
Dowell	Eckman	Pulaski No. 2	16	2240	2500	2300	20	230	100	4.56	.59
Dowell	Eckman	Pulaski No. 3	4	2170	2270	2210	20	130	60	4.51	.63
Dowell	Eckman	Shawnee	3	2300	2380	2330	20	90	60	5.67	.52
Dowell	Elkhorn	Delta	1			2390			150		
Dowell	Elkhorn	Houston No. 1	2	2190	2240	2220	70	110	90	4.60	.48
Dowell	Elkhorn	Houston No. 2	3	2120	2730	2330	50	100	70	5.00	.45
Dowell	Elk Ridge	Elk Ridge	2	2410	2430	2420	150	210	180	5.48	.61
Dowell	Gilliam	Gilliam	4	2180	2300	2250	120	140	130	6.09	.48
Dowell	Hartwell	Berwind No. 5	3	2190	2410	2290	110	310	190	4.17	.83
Dowell	Havaco	Havaco	5	2190	2640	2350	50	150	90	5.66	.74
Dowell	Havaco	Havaco No. 41	1			2240			170	8.19	.81

Table of Softening Temperatures of Coal Ash from West Virginia Coals—Continued.

Table of Softening Temperatures of Coal Ash from West Virginia Coals—Concluded.

Locality, Bed, etc.			Number of Samples from Mine	Softening Temperature °F.			Softening Interval °F.			Average analysis of dry coal percentage of	
POTTSVILLE SERIES. POCAHONTAS GROUP				Lowest	Highest	Average	Lowest.	Highest	Average	Ash	Sulphur
1			2	3	4	5	6	7	8	9	10
County	*Town*	*Mine*									
owell	Huger	Lake Superior No. 1	6	2280	2370	2310	40	60	40	4.66	.73
owell	Huger	Middle States	1			2420			90	8.78	.85
owell	Jenkinjones	Pocahontas No. 6	11	2170	2390	2240	40	220	90	4.92	.51
owell	Jenkinjones	Pocahontas No. 6-b	2	2220	2280	2250	20	60	40	5.68	.48
owell	Jenkinjones	Pocahontas No. 7	9	2120	2490	2270	20	170	110	5.62	.53
owell	Jenkinjones	Pocahontas No. 7-a	1			2450			210	4.99	.49
owell	Jenkinjones	Pocahontas No. 8	9	2190	2450	2320	40	300	140	5.16	.59
owell	Kimball	King	4	2160	+3010	+2420	*80	*150	*120	4.83	44
owell	Leckie	Leckie No. 1	6	2510	2830	2710	100	180	140	3.32	.57
owell	Leckie	Leckie No. 2	5	2510	2790	2640	80	160	120	3.39	.55
owell	Lick Branch	Delta	3	2190	2230	2210	80	140	110	4.30	.45
owell	McDowell	McDowell	3	2420	2490	2450	40	290	150	3.93	.43
owell	Maybeury	Norfolk	2	2690	2730	2710	120	140	130	10.33	.55
owell	Newhall	Berwind No. 6	2	2540	3070	2810	220	290	260	4.90	.63
owell	Newhall	Berwind No. 7	3	2520	2730	2610	110	250	190	4.27	.63
owell	Newhall	Berwind No. 8	3	2520	2970	2690	90	320	190	4.43	.65
owell	North Fork	Rolfe	6	2220	2640	2400	40	250	120	4.42	.52
owell	Vivian	Tidewater	3	2240	2300	2270	70	180	110	5.63	.55
owell	Welch	Standard Pocahontas	2	2430	2470	2450	70	100	90	7.36	.97
owell	West Vivian	King No. 98	1			2280			70	4.53	.58
er	Coaldale	Coaldale	3	2300	2540	2410	140	190	160	4.07	.70
er	Goodwill	Goodwill	4	2540	2710	2620	60	130	90	3.37	.58
er	Goodwill	Louisville No. 1	1			2410			100	3.43	.59
er	Goodwill	Louisville No. 2	4	2490	2710	2640	100	160	130	3.82	.53
er	Goodwill	Louisville No. 3	1			2690			140	3.25	.55
cer	McComas	Sagamore No. 1	3	2430	2600	2540	80	190	140	4.47	.50
cer	McComas	Sagamore No. 2	3	2460	2520	2490	160	220	200	3.87	.43
cer	Matoaka	Pawama No. 1	2	2450	2580	2820	80	300	190	3.85	.77
cer	Matoaka	Pawama No. 2	3	2580	2660	2620	60	80	70	4.34	.79
cer	Matoaka	Thomas No. 1	5	2440	2610	2520	40	440	240	5.30	.54
cer	Matoaka	Thomas No. 2	4	2650	2960	2750	80	260	170	4.95	.52
cer	Mora	Crane Creek No. 1	2	2390	2620	2500	130	300	220	3.88	.69
cer	Mora	Crane Creek No. 2	3	2530	2730	2600	100	360	240	4.80	.55
cer	Mora	Pinnacle	5	2350	2530	2470	120	400	240	3.48	.54
cer	Mora	Sagamore No. 1	3	2410	2530	2460	170	190	180	3.93	.56
cer	Mora	Sagamore No. 2	4	2470	2510	2490	40	230	140	4.10	.59
cer	Simmons	Booth-Bowen	3	2470	2540	2500	40	250	140	4.40	.58
cer	Simmons	Buckeye No. 1	3	2370	2530	2480	40	210	140	3.40	.60
cer	Springton	Modoc No. 1	4	2600	3050	2740	40	170	90	3.66	.59
cer	Springton	Modoc Nos. 2 and 3	4	2510	2720	2640	50	120	80	3.67	.57
cer	Weyanoke	Weyanoke No. 1	9	2450	3010	2690	80	340	190	4.40	.59
cer	Weyanoke	Weyanoke No. 2	1			2570			100	4.05	.60
cer	Widemouth	Piedmont	4	2690	2890	2800	60	120	80	5.73	.52
rage of Pocahontas No. 3, (Pocahontas Thick Vein) Bed			246			2440			140	4.70	.59

CHAPTER XI.

WATER-POWER, MINERAL WATERS, IRON ORE, AND FORESTS.

WATER-POWER.

AVAILABLE STREAMS

No attempt has been made to utilize the streams of Webster for hydro-electric power, although numerous water-wheel mills have been built along the various creeks for the purpose of sawing lumber and grinding grain, and some of these are still in operation. The streams worthy of attention for commercial power development are the Little Kanawha, Holly, Elk, Gauley, Williams, and Cranberry Rivers, all of which have a variable run-off, much greater in spring and winter than in summer and fall. Of these streams, gage readings are available for Elk River at Webster Springs and Gauley River at Allingdale, which is located in Nicholas County, just west of the Webster line. These records have already been published under the description of these drainage basins, pages 28-47.

Of the rivers mentioned above, the Elk, Gauley, Williams, and Cranberry offer superior natural advantages for economic power development. The Elk River, in that portion of its valley above the Holly-Fork Lick District Line, has cut its channel into the Mauch Chunk Shales entirely below the coal measures so that no mining rights would be seriously

handicapped by dams of moderate height, and the mountainous character of most of its drainage basin insures that the thick forest on its headwaters will remain for many years to come, making the run-off much more even than would otherwise be the case. The same statements are true of the Gauley River above Bolair, of the Williams above Dyer, and of the Cranberry above Aldrich Branch. Attention is called to the fact that a difference in level of nearly 900 feet exists between Elk River at Webster Springs and Gauley River at Bolair, and as the distance between the two streams is comparatively short it would be possible to extend a tunnel from Gauley to Elk and secure a tremendous head of water, this project having been actively urged some years ago by the late Hon. C. P. Dorr, of Webster Springs. Presumably there would be legal difficulties in the way of such a diversion of the waters of Gauley but the physical difficulties of the plan would not be excessive.

The following table, prepared by Mr. Tucker and showing indicated horse-power developed by streams flowing through the county, is compiled from Tables 5, 6, 7, and 8, pages 404-408, of the Semi-Centennial History of West Virginia, by J. M. Callahan, the tables in question being part of a special article on "Water-Power Resources" by A. H. Horton, District Engineer, Water-Resources Branch, U. S. Geological Survey:

Indicated Horse-Power Developed by Gauley and Elk Rivers and Their Tributaries.

Stream	Section of Stream		Length. Miles	Mean Drainage Area Square Miles	Minimum Discharge Second Feet	Assumed Discharge Maximum Development Second Ft	Total Fall. Feet	Minimum Horse-Power	Assumed Maximum Development Horse-Power.	Horse-Power Available from Storage for		
	From	To								12 Months	6 Months	3 Months
Gauley River	Source	Below Williams River	33	a 181	38	217	2,000	1,750	10,000			
Gauley River	Below Williams River	Above Cranberry River	17	209	44	253	280	1,130	6,520			
Gauley River	Below Cranberry River	Above Meadow River	31	573	62	462	,770	4,390	32,700	3,720	7,440	14,880
Gauley River	Below Meadow River	Mouth	27	1,310	157	936	b 480	6,930	41,300	10,400	20,800	41,600
Totals			108					3,530	14,200	90,520	14,120	28,240	56,480
Gauley River Tributaries:												
Cranberry River	Source	Mouth	30	a 102	5	55	2,100	241	2,650			
Cherry River	Source	Mouth	25	a 168	8	90	2,000	368	4,140			
Muddlety Creek	Source	Mouth	22	a 66	3	36	1,000	69	828			
Hominy Creek	Source	Mouth	18	a 98	5	53	1,500	172	1,830			
Meadow River	Source	Below Big Clear Creek	19	a 165	8	89	1,400	258	2,860			
Meadow River	Below Big Clear Creek	2,200-ft. Contour	18	222	10	119	300	276	3,280			
Meadow River	2,200-ft. Contour	1,800-ft. Contour	11	295	14	159	400	516	5,840			
Meadow River	1,800-ft. Contour	Mouth	8	350	22	189	670	1,360	11,700			
Twentymile Creek	Source	Mouth	30	a 75	4	40	1,400	129	1,290			
Totals								3,389	34,418			
Elk River	Source	Below Back Fork	40	a 227	38	177	2,500	2,180	10,200			
Elk River	Below Back Fork	Above Holly River	25	282	47	220	550	2,380	11,100			
Elk River	Below Holly River	Above Birch River	30	552	52	310	180	861	5,130			
Elk River	Below Birch River	Above Buffalo Creek	25	832	55	467	c 50	253	2,150			
Elk River	Below Buffalo Creek	Mouth	51	1,280	60	729	150	828	10,100	19,000	38,000	76,000
Totals			71					3,430	6,502	38,680	19,000	38,000	76,000
Elk River Tributaries:												
Holly River	Source	Mouth	25	153	26	120	2,000	1,200	5,520			
Birch River	Source	Mouth	32	139	23	108	2,000	1,060	4,960			
Buffalo Creek	Source	Mouth	21	113	19	88	1,400	611	2,830			
Big Sandy Creek	Source	Mouth	32	101	17	79	410	160	745			
Blue Creek	Source	Mouth	23	58	10	45	280	84	1,100			
Little Sandy Creek	Source	Mouth	22	67	11	52	920	232	290			
Totals								3,327	15,445			

a Total area.
b. Fall reduced to 300 feet by proposed Gauley reservoir.
c. Fall reduced about 25 feet by proposed Elk River reservoir.

MINERAL WATERS.

MEDICINAL WELLS AND SPRINGS.

Webster County has a well-established reputation for its medicinal waters. These have been exploited mainly at Webster Springs where a strong stream of salt sulphur water, highly impregnated with gas, bubbles from the bed of Elk River near the mouth of the Back Fork, evidently coming from a fissure in the Greenbrier Limestone, the top of which is visible at various near-by points. This old spring, known to the hunters of pioneer days as the "Fork Lick," and eventually giving its name to Fork Lick District, was in early times a rendezvous for deer and other animals that sought its salty waters. The presence of salt at the Fork Lick led the early pioneers to believe that a more abundant supply of brine could be found by drilling wells to a lower depth and such indeed proved to be true when Addison McLaughlin, sometime in the decade between 1850 and 1860, drilled a hole in the bottom a short distance west of the public square on which the Court-House now stands. The old well (No. 19 on Map II), which is now the property of Col. John T. McGraw, owner of the Webster Springs Hotel, was drilled to a depth of 169 feet, finding salt sulphur water at the base of the first streak of lime, and salt water at the bottom of the hole, and since that time has flowed a strong stream of salt sulphur water, highly impregnated with hydrogen sulphide gas, its product being used both for salt baths and for internal medic inal purposes. Recognizing the possibilities of this water the Baltimore and Ohio Railroad Company built a hotel on the property, the same having been later acquired by Col. McGraw, who made extensive additions and improvements, and now operates it. The water from this well is not only used by a large number of summer visitors who come to the Springs annually but also is shipped out to an extensive trade.

The following analysis of the salt sulphur water made by Penniman & Brown, Analytical Chemists, of Baltimore, Md., has been furnished the Survey by P. J. McGuire, Manager of the Webster Springs Hotel:

	Grains per U. S. Gallon
Silica	0.86
Alumina	1.20
Oxide of iron	0.27
Calcium carbonate	13.44
Strontium carbonate	3.24
Sodium phosphate	1.04
Sodium sulphate	trace
Calcium chloride	105.56
Magnesium chloride	45.76
Manganous chloride	trace
Potassium chloride	3.41
Lithium chloride	5.69
Sodium chloride	989.56
Ammonium chloride	0.35
Total	1,070.38

The following analysis of water from the old "Fork Lick" Spring at the mouth of Back Fork, made by C. D. Howard, Chemist of the West Virginia Experiment Station, Morgantown, West Virginia, under date of May 1, 1904, was furnished the Survey by Mr. McGuire:

	Grains per U. S. Gallon
Ammonium chloride	0.290
Potassium chloride	1.282
Lithium chloride	0.417
Sodium chloride	343.217
Caesium chloride	absent
Rubidium chloride	absent
Magnesium chloride	12.167
Calcium chloride	17.798
Sodium bromide	0.210
Sodium iodite	0.058
Sodium bisulphate	0.762
Sodium thiosulphate	0.366
Sodium thioarsenite	trace
Sodium meta borate	0.087
Ferrous bicarbonate	0.051
Manganese bicarbonate	0.021
Calcium bicarbonate	17.606
Strontium bicarbonate	0.626
Barium bicarbonate	0.777
Calcium fluoride	trace
Calcium phosphate	0.007
Alumina	0.002
Silica	0.454
Albuminoid ammonia	absent
Sulphur dissolved as persulphate	0.058
Total	396.246

Gases

	Cubic Inches per Gallon
Free carbonic acid	1.54
Half bound carbonic acid	10.22
Dissolved oxygen	0.17
Nitrogen	Undetermined
Sulphuretted hydrogen	0.85
Carburetted hydrogen	Considerable
Temperature	56° Fahr.

Subsequent to the drilling of the well on the Webster Springs Hotel property, several others have been put down to the salt sulphur and salt water horizons, some of these having been located in the town immediately north of the old well and others having been drilled below the mouth of Back Fork in the suburb known as "Dorrtown," where the salt water horizon has been found exceptionally rich in brine. Nearly all of these wells flow naturally, but little use has been made of the water except at the William Smith Well (No. 18 on Map II), which is located in Dorrtown and the water from which is being used extensively for medicinal and bathing purposes. According to Mr. Smith, the salt water was found at 71½ feet, its occurrence being evidently at a higher level in the limestone than that found in the McGraw Well.

Wells drilled into the Greenbrier Limestone elsewhere in the County do not record either salt sulphur or salt water, and while it is true that not enough wells have been drilled throughout the county to warrant a positive statement that these mineral waters will not be found in quantity in other localities, it seems quite probable that their occurrence is limited to a local area around Webster Springs where the Webster Spring Anticline interrupts the general monoclinal structure and with its reversal of dip retards and segregates the northwestward flow of water along the strata.

In the Pottsville Series of Webster County the presence of salt water, such as is found in many counties farther north and west, does not seem to be general, as the logs of wells drilled to the bottom of the series for oil and gas do not record it. Along Laurel Creek of Elk, however, in the region north of Arcola, Glade District, certain coal test wells (Nos. 16 and 17 on Map II), bored several years ago, still flow a

considerable amount of slightly sulphurous water, as previously described on pages 273-4, their source being probably in the lower members of the Pottsville.

IRON ORE.

POSSIBLE SOURCES OF ORE.

Iron ore, in quantity and quality sufficiently good to compete at the present time with the commercial products of other mining regions does not seem to exist in the surface deposits of Webster. Only scattered and lenticular nodules of iron carbonate were found in certain of the sandy and aluminous shales lying above and below the coal seams of the Allegheny and Pottsville Series in various localities in the county. Their presence, as noted in the Measured Sections of Chapter IV, the stratigraphic descriptions in Chapters V to VII, and under the descriptions of Commercial Coal in Chapter X, is of such scant quantity as to warrant the statement that iron ore in commercial proportions will never be found in the Pennsylvanian rocks.

Attention has already been called, however, (see page 213), to the great amount of red Mauch Chunk Shale that crops in the valleys of Elk, Gauley, Williams, and Cranberry Rivers, in the southeastern quarter of the county. These shales contain a small proportion of iron oxide, probably varying from 5 to 10 per cent., the sum total of which is enormous. While it is true that this iron oxide can not now be classed as "ore," in the generally accepted trade meaning of the term, the ability of the mining fraternity in devising methods for handling low-grade deposits, long regarded as worthless, provided they occur in such quantity as to warrant the installation of large and efficient labor-saving machinery, has been such as to make it seem possible that at some future date the Mauch Chunk Shales can be mined for iron after all the richer ores have been exhausted.

FORESTS.

In Volume V, pages 307-308, of the State Survey Reports (1898), by A. B. Brooks, State Forester, there is a description of the "Present Forest Conditions" that is of pertinent interest and is here republished in full, to show not only what timber is now available, but also what is likely to thrive, should reforestation be taken up:

"Present Forest Conditions.

"A belt of mountain land averaging 10 miles in width and 25 miles in length and including the southeastern third of the county is still in virgin forest, except that the best poplar has been removed from an area of about 15,000 acres lying on the south side of Williams River and its Middle Fork, and from 8,000 acres on the north side of Gauley River. Outside of this belt there are virgin forests on the headwaters of Holly River in the northeast and on the Elk River between Webster Springs and the Braxton line, making in all an area of about 122,000 acres. The cut-over forests—aggregating about 133,000 acres—lie in nearly all sections, but are most extensive in the region drained by the several tributaries of the Holly River, and along the northwestern side of the county. Extensive areas are also found on the Gauley and Williams Rivers and on the Elk River west of Webster Springs. Of the remaining 122,600 acres, about one-third is cleared and the balance is in culled woodlots.

"The variety of timber trees growing in the forests of Webster County is very great. All along the southeastern side there is a belt of red spruce which varies in width from 2 to 6 miles. The irregular northwest boundary line of the spruce belt crosses Bergoo and Leatherwood Creeks of Elk, the Gauley River below its three forks, Williams River near the mouth of Little Beechy Run, and the Cranberry River north of Hanging Rock. Such trees as hemlock, sugar maple, beech, yellow birch and wild cherry are frequently found growing with the spruce or in almost pure stands on lower ridges and mountainsides. Westward from the spruce belt are the valuable forests of yellow poplar, cherry maple, basswood, chestnut, and other hardwoods. An experienced timber cruiser gives the following list of timber trees growing on a 20,000-acre tract on Elk River:

"Yellow Poplar	25 per cent.
Chestnut	25 per cent.
Oaks	12 per cent.
Sugar Maple	13 per cent.
Basswood	5 per cent.
Spruce	5 per cent.
Hemlock	5 per cent.
Others (including beech, birch, ash, cherry)	10 per cent.

"In other sections the percentage of some species named above would be low and that of others high according to the elevation of the tract, etc.

"Most of the area in Webster County now occupied by virgin and cut-over forests should always remain as forest land. There are at least three good reasons why this is so: First, the land is not in any sense agricultural; second, it is capable of producing, naturally, an abundant and profitable yield of timber; and third, the region is of preeminent value for its effect upon the flow of waters which finally reach the Ohio River through the Elk, the Gauley, and the Great Kanawha.

"In the glady regions near Cowen truck-growing will doubtless become very profitable, and there are many sections throughout the northwestern half of the county where fruit and the ordinary farm crops can be successfully grown. The agricultural areas are small, however, and the county must protect and encourage the growth of its forests as the principal source of wealth."

While it is true that the forests of Webster constitute a great source of wealth, as stated in the last paragraph of the above quotation, it should not be forgotten that the commercial coal, as described in Chapter X of this Report, will eventually produce a much larger return than may be obtained from forests.

Since the publication of Mr. Brooks' Report in 1908, a large amount of timber has been cut in Webster but enormous quantities still remain on the waters of Elk, Gauley, Williams, and Cranberry Rivers in the southeastern quarter of the county.

AREAS SUITABLE FOR REFORESTATION.

The topography of Webster is so rough and the soils are so poor that it would seem probable that some Government or State policy of keeping the mountain sides and ridges of a considerable part of the county in perpetual forest would be

advisable, confining agriculture to the valleys and lower portions of the uplands, as the eventual return from the land under such a system would be greater than if it were cleared and farmed.

FOREST PROTECTION SERVICE.

Some of the large landowners in southern Webster are subscribers to the Central West Virginia Fire Protective Association, a semi-official organization, supported in part by State and Government funds, but largely by private assessment based on acreage. This association has several lookout stations and patrol routes and since its organization has saved much valuable timber from fire. In addition to this semi-public body the various companies keep private patrolmen on their property during the dry seasons of spring and fall who help reduce the fire hazard to the desired minimum.

LUMBER MILLS.

Some of the timber of the county is being sawed by small portable mills, no account of which is available. The following are the principal woodworking establishments:

Mayton Lumber Company.—The Mayton Lumber Company, having its general office at Weston, W. Va., and its mill on Left Fork of Holly River, one mile west of Hacker Valley, was established in 1909, having succeeded the Butts-McCormick-Wilson Company. According to H. R. Wilson, Superintendent, the company manufactures rough hardwood lumber, the output of the band mill being 40,000 feet B. M. daily, and employs a force of 56 men in the mill, of whom 25 are skilled laborers, and about 150 additional men in the woods and railroad crews and in its coal mining plant which supplies fuel for the locomotives, the average monthly pay-roll being $9000. The timber comes mostly from the head of Left Fork of Holly River and the output of the mill is hauled over the narrow-gauge road of the company to Pickens where it is classified for eastern shipment.

The **Hollywood Lumber and Coal Company,** having a mill on Holly River, at Palmer, Braxton County, the **Oak**

Run Lumber Company, with a mill on the same stream a short distance above Palmer, the **Cherry River Extract Company**, having storage yards for chestnut extract wood on Holly River above Palmer and a narrow-guage railroad at Tracy on Elk River, and the **Nuzum Lumber Company**, having a mill at Holly Station, at the forks of Holly River, all get a considerable portion of their timber on the two branches of Holly River in Webster County, the two first-named companies having narrow-gauge railroad lines to bring in their raw material, the output being mostly handled by the West Virginia Midland Railroad.

Narrows Run Manufacturing Company.—The Narrows Run Manufacturing Company, established in 1916, operates a small circular sawmill with a daily capacity of 15,000 feet, at the mouth of Narrows Run of Right Fork of Holly River, its logs being hauled from Narrows Run over the narrow-gauge railroad of the company, and the product being shipped over the West Virginia Midland Railroad.

Hanford Nichols Mill.—The Hanford Nichols Mill, located on Right Fork of Holly River at Diana, secures its logs from Right Fork of Holly River and Grassy Creek, having its own narrow-gauge railroad, its output being rough lumber, shipped over the West Virginia Midland Railroad.

Brooks Run Lumber Company.—The Brooks Run Lumber Company, successor to the Acadian Lumber Company, having a mill at Prestonia, on Laurel Creek of Elk River, along the Richwood Branch of the Baltimore and Ohio Railroad, secures most of its timber from Brooks Creek, Braxton County, the same being hauled to the mill on the narrow-gauge railroad of the company.

Moon Lumber Company.—The Moon Lumber Company, of Erbacon, having its principal source of supply in Braxton County, has a daily output of 20,000 feet, according to George Gillespie, Manager, the product being shipped over the Baltimore and Ohio Railroad.

Davis-Eakin Lumber Company.—The Davis-Eakin Lumber Company, established in 1911 with general offices at Weston, W. Va., operates a mill at Skyles, located at the mouth of

Skyles Creek on Birch River at the Webster-Nicholas line. According to C. O. Thayer, Superintendent, the company manufactures rough hardwood lumber, principally, the mill being of the single-band type, with an output of 35,000 feet daily. Timber for this operation comes from the waters of Birch River, partly in Webster, partly in Braxton, and partly in Nicholas County, the output of the mill being hauled to the Baltimore and Ohio Railroad at Erbacon over the Erbacon and Summersville standard-gauge railroad which also gathers the logs, the road being the property of the mill owners. The working force includes 89 men in the woods gang, 58 in the mill, and 44 on the railroad, making a total of 191, with an average monthly pay-roll of $11,000.

Harmount & Hall Mill.—The Harmount & Hall Mill, located at Wainville on the Richwood Branch of the Baltimore and Ohio Railroad, secures its logs from Amos Run of Laurel Creek, the same being hauled to the mill on the narrow-gauge line of the company.

Smoot Lumber Company.—The Smoot Lumber Company, with general offices at Cowen, operates a mill at Arcola, on the Richwood branch of the Baltimore and Ohio Railroad, the plant having been built in 1910. According to C. D. Howard, General Manager, the mill has a daily capacity of 30,000 feet, the output consisting of rough hardwood lumber, there being 120 men employed in the mill and woods gangs and on the railroad, with an average monthly pay-roll of $5,500. The timber comes principally from the Gauley River below Bolair, being hauled over a narrow-gauge railroad of the company, the total trackage being 15 miles.

The **Cherry River Boom and Lumber Company (Gauley Mill)** and the **West Virginia Wastewood Chemical Company,** both operating at Gauley Mills on Gauley River, along the Richwood Branch of the Baltimore and Ohio Railroad, have been previously described under the account of Gauley Mills, pages 16-17. Another mill of the former company, operating at Richwood, secures a considerable portion of its logs on the Cranberry River drainage in Webster.

The **West Virginia Pulp & Paper Company**, having general offices at 200 Fifth Avenue, New York City, and mills at Cass and Spruce, in Pocahontas County, secures a considerable portion of its logs from the headwaters of Elk River in Pocahontas, Randolph, and Webster Counties, the same being hauled to Cass over the Greenbrier, Cheat and Elk standard-gauge railroad of the company.

CHATPER XI.

CLAY, LIMESTONE, BUILDING STONE AND ROAD MATERIAL.

CLAYS AND CLAY INDUSTRY.

PRESENT LACK OF DEVELOPMENT.

No clay industry exists in Webster at the present time. There are no brick or tile plants, and so far as known no attempt has ever been made to start them, although there is an abundance of raw material suitable for both purposes. The great abundance of cheap lumber has naturally retarded the use of brick as a building material for local purposes and the distance of the county from outside markets and somewhat unfavorable shipping facilities have tended to preclude the establishment of the industry in competition with other more favored communities.

AVAILABLE CLAY AND SHALE.

Transported Clay.

Along the flood-plains of the Holly, Elk, Gauley, and portions of Williams Rivers, as well as on some of the smaller streams, there are large deposits of river clay, varying in thickness from 5 to 15 feet, that are suited for common building brick, such as will be desired when the increasing cost of lumber will preclude its use for residential purposes. In addition to these flood-plain deposits, there are large areas of white terrace clay in the Cowen Glades, that would make either brick or drainage tile such as is needed in that immediate vicinity. No attempt is made to name all these deposits in detail, but Map II, showing the alluvial deposits in yellow, will be a guide to their occurrence.

Residual Clay.

Residual clay, which is derived from weathered rocks and shale, and is still in its original location, is not of sufficient importance to be classed as a building material in Webster, the most of it having washed down the mountainsides to the river valleys below. Whatever of these deposits still remain in place should rather be classed as soil, more valuable for agricultural than for other purposes.

Stratified Shales.

Stratified shales, composed principally of silica and alumina, and lying between the sandstone ledges of the Allegheny and Pottsville Series, which crop throughout Webster, compose a considerable portion of the surface measures of the county. Nearly all of these shales are of material that could be made into brick of some sort, some of them being suitable for paving purposes, while others would make nothing better than common building brick. In the southeastern quarter of the county the red shales of the Mauch Chunk Series crop along the valleys of Elk, Gauley, Williams and Cranberry Rivers, there being enormous deposits, often 100 feet or more in thickness without any intervening sandstone ledges. These red shales, as revealed in the sections of Chapter IV and as described in detail in Chapter VIII, and as shown on Map II, constitute an inexhaustible supply of brick or tile material which could be quarried at extremely low cost, and, as coal is available in the mountainsides above, fuel for burning could be secured at a minimum cost. These shales are best suited for building brick or tile, since they would burn to a rich red color of pleasing tone. It is probable that as paving brick they would not prove to be as durable as some of the fire clay shales of the northern counties of the State, but their low cost would justify their use for this purpose locally if used on a concrete sub-grade which would tend to reduce to a minimum the crushing effect of vehicle traffic. In addition to the low cost of first construction the use of such local material is often justified by the fact that such a course keeps money at home while the use

of outside material, even if of a somewhat better grade, tends to drain the county of its resources.

Fire Clay.

High-grade refractory fire clays of commercial thickness and purity are almost unknown in Webster. The only flint clay of any consequence found was the Upper Kittanning Fire Clay, which was noted near the summits of some of the high ridges in Hacker Valley District, with an apparent thickness of 2 to 5 feet. This clay has been previously discussed in Chapter V, pages 134-5, where all exposures noted are described in detail.

LIMESTONE.

AVAILABLE DEPOSITS.

No limestones of consequence outcrop in the county except those of the Mauch Chunk and Greenbrier Series. Of the former the only calcareous strata worthy of note for concrete or road purposes are the Hinton Limestone, coming near the base of the Mauch Chunk, and the Greenbrier Limestone, which composes the Greenbrier Series. These two beds of lime crop only along Elk River, the top of the Greenbrier being exposed at Webster Springs, and the Hinton and Greenbrier being exposed again farther up Elk, principally in that portion of Randolph treated in this Report. These various exposures have been discussed in detail in Chapter VIII, to which reference is made for a statement of their thickness and character.

BUILDING STONE.

QUARRIES.

In Chapters V to VIII, inclusive, the various sandstone quarries found in Webster have been classified under their respective geologic names, there being only a few small quarries in the county, the stone having been mostly used for railroad bridge abutments. Under the next heading entitled "Available Stone" will be found a list, containing not only the quarry horizons previously noted, but also the entire list of sandstone ledges suitable for masonry or concrete material.

AVAILABLE STONE.

The sandstones of Webster, as described in detail in preceding Chapters, vary from flaggy and shaly beds that do not have the necessary cohesiveness to be used for building stone, to great massive ledges, 75 to 100 feet thick, that may be split into building blocks of any desired size. In the Allegheny and Pottsville Series these massive ledges are all much of the same type, micaceous, gray on fresh fracture and often weathering to brown, some of them being very soft and worthless while others are hard and durable. Most of them do not have the beauty of texture or smoothness of grain to make them desirable for architectural purposes where ornamental or carved-stone effects are desired. In all structures, however, where durability and fire-proof construction are the main features desired, they can not be surpassed by any stone shipped in from other counties or States. They are fitted for bridge piers and abutments, retaining walls, and for buildings of plain construction. In nearly every locality one or more of these ledges is of massive character and can be quarried. Many of these outcroppings have been described in detail in the Chapters on Stratigraphy.

In the Mauch Chunk Series the sandstone ledges, as a rule, are flaggy, shaly, and micaceous, there being two exceptions to this general characteristic. The Princeton Conglomerate, coming near the top of the series and outcropping in the southeastern quarter of the county on the waters of Elk, Gauley, Williams, and Cranberry Rivers, is a great massive, conglomeratic ledge, approaching the character of a quartzite. Attempts to quarry it into building blocks have not been very successful, owing to its tough character, but it would seem to be well adapted for concrete aggregate or macadam. The Webster Springs Sandstone, coming practically at the base of the series, and outcropping only in the Elk Valley above Webster Springs, is usually a massive ledge, 50 to 60 feet thick, quite durable in character, and although the joint-planes and bedding are less regular than could be desired,

there are numerous places where it could be quarried successfully for masonry construction. Detailed exposures of these members have been fully described in Chapter VIII.

The following table gives a list of the principal sandstone ledges that would prove suitable for quarrying or for concrete and macadam, those printed in full-faced type having already been used in masonry construction:

Table of Sandstones Available for Masonry Construction.

Name of Sandstone	Geological Series	Approximate Thickness Feet	Page on which Described
Upper Mahoning	Conemaugh	25 to 50	127
Lower Mahoning	Conemaugh	30 to 60	128
Upper Freeport	Allegheny	50 to 75	131-2
Lower Freeport	Allegheny	25 to 50	133-4
Upper East Lynn	Allegheny	20 to 60	135-6
East Lynn	Allegheny	20 to 60	136-7
Homewood	Pottsville (Kanawha Group)	25 to 75	148-9
Upper Coalburg (Upper Connoquenessing?)	Pottsville (Kanawha Group)	20 to 40	152-3
Upper Winifrede	Pottsville (Kanawha Group)	20 to 30	155
Lower Winifrede	Pottsville (Kanawha Group)	20 to 25	157
Upper Chilton	Pottsville (Kanawha Group)	20 to 25	158-9
Lower Chilton	Pottsville (Kanawha Group)	20 to 40	159
Upper Cedar Grove	Pottsville (Kanawha Group)	20 to 40	161
Peerless	Pottsville (Kanawha Group)	20 to 50	163-4
Monitor	Pottsville (Kanawha Group)	30 to 50	164-5
Brownstown	Pottsville (Kanawha Group)	20 to 50	167-8
Eagle	Pottsville (Kanawha Group)	20 to 60	172
Decota	Pottsville (Kanawha Group)	10 to 40	174
Grapevine	Pottsville (Kanawha Group)	20 to 30	176-7
Lower Gilbert	Pottsville (Kanawha Group)	30 to 80	180-1
Dotson	Pottsville (Kanawha Group)	20 to 65	182-3
Lower Dotson	Pottsville (Kanawha Group)	20 to 30	184
Upper Nuttall	Pottsville (New River Group)	30 to 80	188-9
Lower Nuttall	Pottsville (New River Group)	50 to 90	190-1
Harvey	Pottsville (New River Group)	20 to 35	194-5
Guyandot	Pottsville (New River Group)	20 to 40	197-8
Lower Guyandot	Pottsville (New River Group)	10 to 35	201-2
Welch	Pottsville (New River Group)	10 to 35	205
Upper Raleigh (Sharon)	Pottsville (New River Group)	30 to 70	206-8
Princeton	Mauch Chunk	30 to 150	215-17
Webster Springs	Mauch Chunk	30 to 100	227-8

ROAD MATERIAL.

RIVER AND CREEK GRAVEL.

Attention has been called in many previous Reports of the Survey to the fact that most of the rivers and creeks of the State contain an abundant supply of gravel, which, being the more resistant portions of the rocks from which they came, afford good material for improving roads that is often cheaper than any other that can be secured. The roads often follow the streams closely, making it possible to macadamize with gravel at much less cost than with stone quarried from the hills. This general statement holds true in Webster, there being an inexhaustible supply of this material, well distributed throughout the county.

SAND.

Sand, which is another essential material needed in road building, both in masonry construction and in concrete, is found generally along the rivers and principal creeks of Webster, and as it is mostly derived from the coarse sandstones of the Pottsville Series, it is usually sharp and reasonably free from organic accumulations.

LIMESTONE FOR CONCRETE AND MACADAM.

As stated previously, page 539, the only outcropping limestone in the county that is suitable for concrete aggregate or macadam is located in the Elk River Valley above Webster Springs, the Hinton Limestone of the Mauch Chunk Series and the Greenbrier Limestone of the Greenbrier Series being the two members that are available. Both of these beds are admirably suited for either purpose.

BRICK MATERIAL.

As stated in Chapter XI, pages 538-9, under the heading of "Stratified Shales," there is an abundance of material that can be made into brick, some of it probably durable enough to answer local purposes for road pavement, provided a sub-

grade of concrete be provided to carry some of the shock of traffic.

SANDSTONE FOR MASONRY, MACADAM AND CONCRETE.

In Chapter XI, pages 540-1, under the heading "Available Stone" there is given a discussion of the merits of the various sandstone ledges of the county, as well as a table of references to the detailed descriptions of the various beds on previous pages. In almost every portion of the county there may be found one or more outcropping ledges that can be used for massive masonry construction, as well as for concrete aggregate While it is true that sandstone is not an ideal material for macadam certain of the more resistant ledges such as the Princeton Conglomerate of the Mauch Chunk Series could profitably be used for local macadam, because of the low first cost.

PART IV.

Paleontology.

CHAPTER XIII.

NOTES ON THE PALEONTOLOGY OF WEBSTER COUNTY.

INVERTEBRATE FOSSILS FROM THE POTTSVILLE SERIES.

By W. Armstrong Price.

INTRODUCTION.

The report on the fossils collected from Webster County (a summary of the contents of which is given below, under the heading: "Scope of the Investigation") is accompanied by discussions of several subjects having a bearing upon, or being the outgrowths of, the study of the fossiliferous strata of the county. Two studies resulting from an examination of a large number of specimens of the brachiopod genus *Derbya* and a discussion of the correlation of certain fossiliferous beds in Preston and Mingo Counties, with a note on collections of fossils from the Winifrede Limestone in Kentucky, precede the discussion of the Webster County fossils. A table showing the range and distribution of fossils noted in this report from other areas accompanies that for the fossils of Webster County.

MAXIMUM SIZE OF WEST VIRGINIA DERBYAS AS INFLUENCED BY SEDIMENTATION

The subject of the influence of the environment upon the organism, although of great significance in deciphering the history of living things, is in too many cases neglected by paleontologists or is treated in a cursory manner, conclusions being drawn without an attempt to test them by careful scrutiny of the facts. In the study of groups of fossils primarily for stratigraphic and correlational purposes time is not usually available for detailed studies of environmental factors and many opportunities of increasing the data upon which future ecological studies may be based are thereby lost.

Although time and facilities may be lacking for detailed investigations, such, for example, as those involving chemical and mineralogical analyses of sediments, yet it is felt that opportunities are often presented for less exhaustive studies which would be of value as indicating probabilities, at least, and would form points of departure from which more detailed and comprehensive investigations might be made.

It is in this spirit that the data here presented have been brought together and their bearing upon certain ecological factors in the life of two species of *Derbya* have been studied.

In studying the brachiopoda described in this report all the available specimens of *Derbya crassa* and *D. robusta* from strata of Pennsylvanian age in West Virginia were assembled in order to review the previous citations of these species. The collections thus brought together contained not only shells exhibiting a wide range in size and proportions but also sediments of a variety of lithologic types. The collections from which these shells were assembled had been obtained from localities scattered over a large area of the coal fields of the State and from strata ranging in age from mid-Conemaugh to lower Kanawha and including all the important fossiliferous horizons of the Pennsylvanian strata in this region. For these reasons it appeared that the material must be fairly representative of the two species in West Virginia, although it consisted of not more than about two hundred specimens

from twenty-four localities and *D. robusta* is not represented in abundance.

It was decided to examine this material to see whether any definite relationships might be found to exist between the size of the shells and the lithologic nature of the rocks from which they were obtained and whether from such relationships, if found, environmental factors entering into the control of size might be reasonably inferred from a consideration of the sediments which accumulated in the waters in which the animals lived.

For this purpose a graph has been prepared to show the variation in size of *D. crassa* and *D. robusta* as found in sediments presenting a wide range in lithologic characters and arranged in a series which is believed to represent increasingly favorable environmental conditions for the brachiopods from black shales through sandy sediments to argillaceous limestones.

In order to represent variations in size the width has been recognized as offering a means of deciphering some, at measured and the one most often exhibiting its original extent. *Derbya crassa* and *D. robusta* have been considered as forming a continuous morphological series in which shells of proportions intermediate between the more typical varieties are known. This relationship of the two species is more fully discussed in the description of the genera and species of this report.

The rock in which a fossil is found imbedded has long been recognized as offering a means of deciphering some, at least, of the conditions amidst which the animal lived or died. The brachiopod animal is supposed to have lived, with the exception of a short period during the early larval stage, and to have died resting upon the bottom of the sea at the point where it is found embedded in the rock. In recording the lithologic characters of the matrices in which the specimens of *Derbya* were found only macroscopic features were used. Neither chemical nor mineralogical analyses were made. The rocks of the fossiliferous zones studied have suffered only slight alterations since their deposition. These alterations have consisted of compacting and consolidation of

the original sediments. Compacting and later stresses incident to the rather gentle folding of the region have resulted in the partial flattening and compression of many of the shells. Cementation has not gone so far as to produce rocks of more than average hardness; leaching of the lime carbonate of the shells has been very common, so that in only a few collections is either the shell substance or structure preserved, the form being preserved only by casts in the matrix.

In each of the twenty-four collections examined the width of the largest shell which was sufficiently well-preserved to permit an accurate measurement was recorded. The character of the matrix was also noted and the results thus obtained were arranged in order of increasing shell width. When this had been done it appeared that the sediments were arranged, roughly but distinctly, into three groups. The first group comprised shells of less than average size for the species *D. crassa* and contained black, carbonaceous (and bituminous?) shale and limestone. In the second group were shells of average to large size, for this species, and smaller examples of *D. robusta*, the sediments including chiefly the more calcareous or sandy dark shale and limestone, and light-brown and gray sandy shales and sandstones. The third group of larger shells of *crassa* and small to large sizes of *robusta* were found in light-colored shales without appreciable amounts of sand grains and the purer, light-colored, argillaceous limestones.

The accompanying graph was then made from these data. The vertical axis is morphological and represents increasing shell width in inches and tenths. The horizontal axis is lithological. To this axis no definite quantitative valuation is assigned, the sediments being arranged in the three groups as outlined above. Within each group the components are arranged from left to right in what is taken to be an increasing order of favorable habitat denoting increasing clearness, freshness and liminess of the waters. Each collection from which a measurement of maximum shell width was obtained is plotted and a curve is drawn through the points thus determined. (The numbers on the curve are locality numbers used in this and other reports). Where specimens of *Derbya*

have been obtained from two types of sediment in the same bed at any locality the maximum shell width for each type of sediment is recorded and the locality number appears twice upon the curve.

Several plotted values have not been included in the curve. Only one specimen was obtained at each of three localities, Nos. 14, 68 and 98. It appears from the considerably larger size attained by shells from similar matrices where the collections are well-represented that the shells obtained at Localities Nos. 68 and 98 had not reached adult proportions when entombed. At Localities Nos. 14 and 38 the shells were collected from red shale and red limestone, respectively. Red sediments have not been given a place on the lithologic axis because they are so sparingly represented in the collections. They have been placed at the extreme left near the black group because of the small size of the few shells collected from the red rocks.

From an examination of the graph it appeared that the majority of the West Virginia Derbyas were smaller than the "rather large specimen" of *D. crassa* with a width of 1.3 inches from Missouri described by Meek[1]. It was decided to include with these specimens from Localities Nos. 139[2] and 203 which reach a maximum width of 1.4 inches, only 0.1 inch greater than the dimension given by Meek. Above this are the four localities from which Derbyas of large size have been obtained. It is suggested in the section of this report descriptive of genera and species that a shell width of 1.5 inches be adopted as the upper limit of *D. crassa*. It appears from an examination of the illustrations and descriptions accompanying 21 citations of the two species from other areas as well as from the data here presented that the suggested shell width forms a convenient dividing line between the two species below which will lie the numerous determinations of *D. crassa* and above which only a few scattered citations may be plotted, including all citations of *D. robusta* from other

[1]Meek and Hayden, Smiths. Contr. to Knowl., 1864, vol. xiv, art. v, p. 26.

[2]The shells from this locality were listed as *D. robusta* in the West Virginia Geol. Surv., Braxton and Clay Cos. Rept., 1917, p. 805.

areas than West Virginia which are known to the writer, with two citations of unusually large shells referred to *Orthis umbraculum?* and commonly placed in the synonymy of *D. crassa.*

Certain conclusions as to the influence of the character of the sediment which was accumulating at a given point in the sea upon the size attained by these brachiopod shells seem, from an examination of the graph, to be rather clearly indicated. The most striking feature of the curve is, perhaps, the uniformly small size of the shells from the black sediments. All are distinctly below average size for the species (which may be taken as 1.0 inch in width[3]) and do not exceed 0.7 inch in width. This represents a distinctly dwarfed condition and is a very common mode of occurrence. Although life-conditions in these waters were not favorable to the attainment of large size they were not unfavorable to the growth of large numbers of individuals.

Larger shells have been obtained from dark sediments at two localities. Shells 1.0 inch in width were collected from a dark-gray, fine-grained limestone at Locality No. 113 and large shells referred to *D. robusta* were found in a dark-gray to black, micaceous and argillaceous sandstone from Locality No. 106. Only three shells of large size, 2.0 inches, were collected at the latter place while abundant examples less than 1.5 inches in width were obtained from the same matrix. The presence of these large specimens indicates the introduction of factors which offset the unfavorable factors accompanying the black sediment. The presence of the large amount of sand indicates stronger currents, freshened waters and perhaps a larger food supply.

None of the black rocks examined are noticeably rich in metallic sulphides and seem to be almost wholly of the type of black sediment in which the color is due to carbon uncombined with hydrogen[4], if this may be inferred from the absence of sulphides.

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[3]Grabau and Shimer, North American Ind. Foss., 1909, vol. i, p. 231.

[4]Twenhofel, W. H., Notes on Black Shale in the Making, American Jour. Sci., 1915, vol. xl, p. 277.

A wide range in maximum shell sizes is seen in the gray, sandy shales and limestones, in the sandstones and in the purer limestones. The largest specimens in each species appear to be found in light-colored shales relatively free from sand and in the purer argillaceous limestones. The largest specimens in the collections are from a light-gray, argillaceous limestone. Shells from the more sandy sediments appear to be of medium size, though some of the larger shells are found in such sediments.

Were it possible at this time to present graphs based upon other dimensions, upon average sizes in collections, upon percentages of shells attaining various sizes and upon other morphologic features the conclusions here drawn might be checked and more thoroughly tested. Enough evidence is here presented, however, in the writer's estimation, to indicate a definite relationship between the lithology of the matrix and the maximum size of the shell in these species. The dwarfing effect of black sedimentation upon marine fauna is well-known, and is here clearly shown. The more favorable conditions accompanying the deposition of sand, even when black sediments also are present and the optimal conditions afforded by the deposition of light-colored, argillaceous limestones seem likewise clearly indicated.

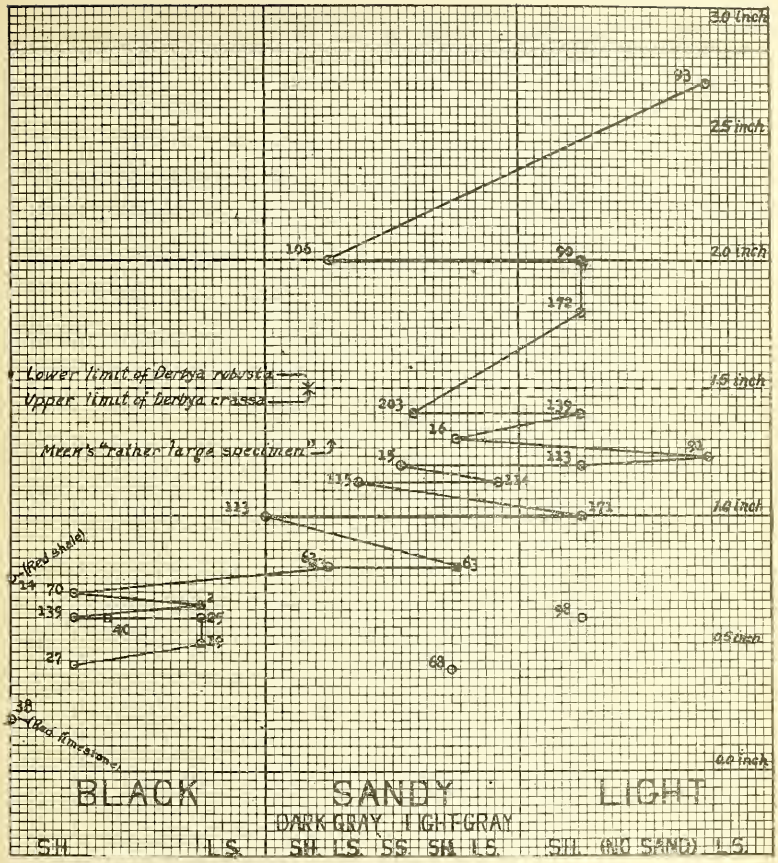

Figure 23.—Chart showing relationship between maximum width of *Derbya crassa* and lithologic nature of the rock in which the shells were found. Vertical axis represents shell widths in inches; horizontal axis represents lithologic types of sediments divided into three groups but having no numerical values. Within each lithologic group the rocks grade from shales on the left to limestone on the right. Red rocks indicated on the chart but having no place on the horizontal axis. Plotted points designated by numbers assigned to the localities from which they were obtained (See Register of Localities) and representing the width of the largest shell obtained at that locality and the rock in which it was found.

AN EXAMPLE OF SHELL REGENERATION IN DERBYA CRASSA.

In a collection of fossils obtained by Mr. D. B. Reger from a stratum of gray, sandy shale outcropping in Webster County, West Virginia[5], were found a large number of impressions of valves of the brachiopod, *Derbya crassa*. These fossils were normal examples of the usual size of mature individuals of the species. One specimen (figure 24, page 555), however, the mold of the interior of a pedicle valve, exhibits upon an otherwise normal shell a tongue-shaped area of abnormal surface sculpture. This area of the shell is supposed to have been formed by a process of shell regeneration. A large piece of the shell appears to have been broken away after the shell had attained its present size. The regeneration was apparently accomplished by abnormal shell growth inward from the anterior margin until the exposed portion of the mantle was entirely covered.

The area of abnormal sculpture extends inward from the anterior margin, as a broad tongue, one side of the tongue being at about the middle point of the margin. In the central portion of the valve it broadens from a width of 0.8 inch into a hemispherical, fan-like expansion 1.0 inch in diameter. The lateral borders of this tongue are indefinite, but posteriorly the fan-shaped portion is bordered by a sharp line where there was a narrow, elevated, crescentic ridge upon the interior of the shell.

The precise outline of the break can not be discerned but the approximate limits may be inferred as having followed closely the elevated, crescentic ridge throughout its length and as having extended from its ends to the anterior margin between the sculpture of the original shell and the area where only abnormal sculpture is shown. The outline as thus inferred is shown in the accompanying diagram (Figure 24).

The new growth appears to have covered a wider area

[5]Locality 293; Mr. Reger considers this fossiliferous stratum to lie at the horizon of the Kanawha Black Flint member of the Pottsville Series of the Kanawha River Valley region of southern West Virginia.

than the hole made in the shell by the break, and, where not ended abruptly by the elevated, crescentic ridge, to have become gradually thinner as it spread over the old shell beyond the edges of the break. This overlapping of the two shell growths served to mend the break and also resulted in superimposing the sculpture of the new shell material upon that of the old where the new layer was thin.

The normal sculpture of the exterior surface of *Derbya crassa* consists of narrow, raised, rounded lirae radiating from the beak outward to the anterior and lateral margins and separated by spaces broader than their width; the lirae become coarser toward the margin and increase in number by the implantation of weaker ones, strong and weak lirae alternating with rather uniform regularity. Crossing these are numerous, fine, closely placed lines and a few strong undulations of growth. Upon the surface of the interior of the valve the lirae are represented by depressed grooves. These become once more raised lirae upon the cast of the interior of the valve. It is from the lirae of the cast that we must, in this case, study the sculpture of the shell.

Upon the tongue-shaped area of regenerated shell there is an inversion of the normal type of sculpture. The lirae diverge from the anterior margin of the valve inward to the borders of the abnormal area and curve outward unsymmetrically upon the expanded central portion where they are approximately doubled in number. The longer lirae are of about equal coarseness. The lirae increase in number by implantation as the expanded portion of the regenerated area is approached; however, the weaker, implanted lirae do not alternate regularly with the stronger and older series, but new lirae originate in bundles of two or three between adjacent stronger ones, producing a fascicular sculpture. Transverse lines crossing the lirae are to be seen and are as faint and inconspicuous as upon the normal shell. Several of these are thickened slightly and appear to represent short periods of slower regenerative growth. Two of the prominent growth-undulations of the normal shell are intersected by the regenerated area and both may be distinguished crossing it unchanged in direction; the stronger of the two is un-

changed in prominence but the weaker becomes faint and indistinct upon the regenerated shell. Covering the whole surface of the cast are very minute pores which indicate minute granular projections from the interior of the shell and are slightly finer upon the abnormal area than elsewhere. Several lirae turn outward upon the surface of the shell beyond the broken area and may be seen crossing the lirae of the original shell, producing a cross-hatched sculpture. They, however, persist for only a short distance.

That the injury took place after the attainment of adult size seems substantiated by the prolongation of normal lirae of the posterior portion of the shell anteriorly to the regenerated area.

It is supposed that the original break extended to the anterior margin of the valve and that regeneration of the lost portion of the shell began there. It is in this region of the mantle that shell formation is normally chiefly accomplished. The normal shell is formed as the result of such marginal shell deposition while the body of the animal increases in size. In the case of the regenerative shell formation of this individual shell, growth appears to have spread backward over the mantle from its anterior margin until the exposed portion became covered with new shell.

The alternative to the method of regenerative growth here postulated is that the new growth started from the inner, expanded margins of the break and proceeded anteriorly into the narrower portion. It is, however, difficult to conceive how the sculpture of the regenerated area could have been formed by a growth in this direction. The continuance of strong lirae across the regenerated area and the direction of their divergence seem to eliminate the possibility of simultaneous growth inward from the entire margin, unless thin layers of shell thus formed have been completely covered by thicker layers built out from the anterior margin. There is no indication of the shell having grown anteriorly after the injury occurred.

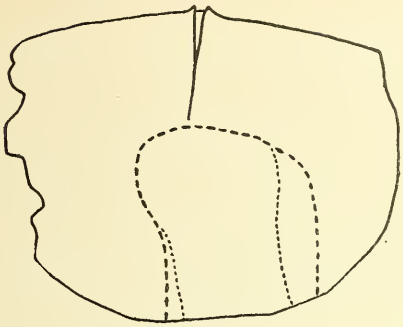

Figure 24.—Outline of a cast of a pedicle valve of *Derbya crassa*, twice natural size, showing an area of regenerated growth. The heavy broken line incloses the area of new growth and abnormal sculpture. Between this line and the lighter, dotted lines are two areas in which the normal shell-sculpture may be seen beneath and crossing the new sculpture. That the break in the shell was slightly smaller than the area of abnormal sculpture is shown by the two small areas of crossed sculpture. *See Fig. 9, Plate xxxiv.

NOTES ON THE CORRELATION OF CERTAIN FOSSILIFEROUS MEMBERS OF THE POTTSVILLE SERIES.

The Winifrede and Buffalo Creek Limestones.—The stratigraphic relation of the Winifrede Limestone of White[6], named from the outcrop of a fossiliferous limestone near Winifrede, Kanawha County, to the Buffalo Creek Limestone of Hennen and Reger[7], named from the outcrop of a hard. gray, fossiliferous limestone on Buffalo Creek and Dick Williamson Branch, Mingo County, has not been satisfactorily settled, the two beds never having been recognized in the same section. In an effort to discover the Winifrede on the waters of Buffalo Creek and to determine its relation to the Buffalo Creek Limestone at the type locality of the latter bed, the writer, in 1917, made a trip to Chattaroy, Mingo County, and obtained a specimen of *Spirifer boonensis* Swallow? from the Buffalo Creek Limestone in the hills at the mouth of the

[6]White, I. C., West Virginia Geological Survey, 1908, Vol. II(A), p. 431.

[7]Hennen, Ray V., and Reger, D. B., 1915, West Virginia Geol. Survey, Logan and Mingo Counties Rept., p. 143.

creek (Locality 176). The search for the Winifrede resulted fruitlessly. There was found at a point 0.8 mile above the mouth of the creek and one hundred feet, stratigraphically, below the Buffalo Creek Coal (Locality 177) a large amount of black shale overlying the "blossom" of a coal bed, both in a mass of shale and soil which had slipped down from its original position. The original location of the shale and coal was not determined with certainty, but it appeared to have come from a point 85 to 95 feet below the Buffalo Creek Coal. It might, however, have come from any height on the hill above. The hill rises to, and somewhat above, the horizon of the Kanawha Black Flint. The geologic sections measured at these two localities are given in the Report on Fayette County[8] and the fossils found in the limestone and shale are there listed with descriptions of three species. The descriptions of these species are repeated in the present report and illustrations are added.

The following species were found in the fossiliferous shale of the landslip (Locality 177):

Serpulites sagittifer sp. nov.	x
Lingula lemniscata Price	aa
Orbiculiodea missouriensis (Shumard)	c
Chonetes granulifer Owen	x
Marginifera wabashensis (Norwood and Pratten)	x
Solenomya radiata Meek and Worthen	x
Nucula parva McChesney?	x
Naiadites carbonaria Dawson?	aa
Aviculipecten pellucidus Meek and Worthen	x
Deltopecten sp.	x
Pleurophorella sesquiplicata Price	aa
Patellostium montfortianum (Norwood and Pratten)	x
Phanerotrema grayvillense (Norwood and Pratten)	a
Gastropoda indeterminata	x
Orthoceratida indeterminata	x
Nautilloidea? indeterminata	x
Plant fragments	c

From the Buffalo Creek Limestone (Locality 176) was found:

Spirifer boonensis Swallow?	x

In 1918, since the sections on Buffalo Creek were examined by the writer, Messrs. Ray V. Hennen and D. B. Reger

[8]West Virginia Geol. Survey, 1919, Fayette Co. Rept., pp. 286 to 289.

have found in Leslie County, Kentucky, a fossiliferous limestone and shale from 10 to 15 feet in thickness which they correlate with the Winifrede Limestone of West Virginia. The limestone found in Leslie County lies 125 to 150 feet above the Hyden Coal. This coal has been correlated by I. C. White, Hennen, and Reger with the Chilton Coal of West Virginia. A five-foot fossiliferous limestone coming 345 feet, stratigraphically, above the Hyden Coal is reported by Hodge[9] in the same county. This limestone seems to lie approximately 200 feet above the lower limestone and is considered by Messrs. Hennen and Reger to be the equivalent of the Buffalo Creek Limestone. The increase in the interval between the Chilton Coal and the Buffalo Creek Limestone in Leslie County as compared with the same interval in Mingo County, West Virginia, is ascribed to a thickening of the intervening strata.

Messrs. White, Hennen, and Reger collected from the Winifrede Limestone at three localities in Leslie County.[10] The collections consisted of only a few pieces of shale and limestone which, however, were highly fossiliferous and have yielded the following species:

[9]Hodge, J. M., Kentucky Geol. Surv., 1910, Bull. No. 11, p. 184.
[10]Localities A, B, and C in Register of Localities, below.

Winifrede Limestone, Leslie County, Kentucky	"A" Leslie Co., location not recorded	"B" Peter Branch of Wolf Creek	"C" Coon Creek
Clinonolithes canna Price		x	
Crinoid columns	x		
Bryozoa (foliate)		x	
Bryozoa (dendroid)		x	
Orbiculoidea capuliformis (McChesney)		x	
Derbya crassa (Meek and Hayden)	x	x	
Derbya? sp.			x
Chonetes granulifer Owen	x	x	x
Productus semireticulatus (Martin)?	x	x	
Pustula symmetrica (McChesney)?		x	
Pustula sp.	x		
Spirifer boonensis Swallow?	?		
Spirifer? sp.			x
Composita sp.		x	
Myalina swallowi McChesney		x	
Naiadites? sp.		x	
Acanthopecten carboniferus (Stevens)		x	
Deltopecten coxanus (Meek and Worthen)		x	x
Allerisma terminale Hall			x
Astartella concentrica (Conrad)	x	x	
Bulimorpha nitidula (Meek and Worthen)?	x		
Ostracoda indeterminata		x	

With the exception of three pelecypods, *Myalina swallowi, Acanthopecten carboniferus* and *Allerisma terminale,* which are known from the Kanawha Black Flint of West Virginia, and of *Deltopecten coxanus* and *Bulimorpha nitidula?,* which are not known in the Pottsville of this State, the determined species of the above list have been found in the Winifrede Limestone of West Virginia. With the exceptions noted, they are, however, species common throughout the marine horizons of the Kanawha Group.

Lists of fossils from the Winifrede and Buffalo Creek Limestones have been given in previous Reports[11] but, as

[11]West Virginia Geological Survey, 1915, Boone County Rept., p. 595.

Idem, 1916, Raleigh and west. por. Summers and Mercer Counties Rept., Table opp. p. 678; Loc. 68, the type locality of the Winifrede Limestone.

Idem. 1917, Braxton and Clay Counties, Rept., p. 805.

yet, the faunules of the Pottsville Series in West Virginia are not known in sufficient detail to permit accurate correlations of the fossiliferous members from point to point by paleontological means alone. The relationship of these two fossiliferous beds has recently been discussed by Hennen in the Report on Fayette County[12].

Fossiliferous Shale Beds in the Rowlesburg Section.— This section, measured by Hennen and Reger and published in the Report on Preston County[13] furnishes the most complete single section of the Pottsville Series obtained in the northern portion of the State. In this section the Pottsville is only 330 feet in thickness.

Two sets of names for the members of the Pottsville Series are now in use in West Virginia —— the Pennsylvania names applied to beds in the thin northern phase represented by the Rowlesburg section and a second set of names which have been applied to beds in the greatly expanded Pottsville section of the Great Kanawha River valley and the southern counties of the State. In the Reports on Braxton, Clay, Barbour and Upshur Counties and in the present Report on Webster County, Hennen and Reger have traced northward the gradually, and sometimes very rapidly, thinning Pottsville measures to the line joining Barbour and Preston Counties and have thus bridged the gap between the two phases of the Pottsville which existed when the Kanawha Valley names were first applied. They have proposed correlations between the beds of the two regions as a result of these field studies.

The Pottsville strata exposed in the Rowlesburg Section were recently examined for fossils by Hennen, Reger, and the writer and two fossiliferous beds lying 66 and 91.3 feet, respectively, above the base of the series were discovered. The correlation of these beds has been discussed by Reger

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[12]Hennen, Ray V., West Virginia Geol. Survey, 1919, Fayette County Rept., p. 243.

[13]Hennen, Ray V., and Reger, D. B., West Virginia Geol. Survey, 1914, Preston County Rept., pp. 96 to 101.

in the Report on Barbour and Upshur Counties[14] and by Hennen in the Report on Fayette County[15]. The lower of the two fossiliferous strata lies immediately above the Sharon Coal (of Preston County) and 15 feet above the top of the great conglomerate ledge of the Sharon Sandstone, 51 feet in thickness, which has been traced by Reger along the crests of Laurel Ridge and Rich Mountain to Hartridge and Mill Creek in Randolph County where it underlies the Sewell Coal and Hartridge Black Shale. The Sewell Coal has been carefully traced northward from its type area in Sewell Mountain, Fayette County, to Randolph County by Hennen and Reger. Thus the identity of the Sewell with the Sharon Coal of Pennsylvania and of the Hartridge Black Shale with the fossiliferous shale lying 15 feet above the top of the Sharon Sandstone seems to be established. In the 6 inches of black, siliceous, finely laminated shale above the coal were found abundant specimens of *Lingula kanawhensis* Price. In the dark-gray, siliceous shale (Locality 207) immediately over the small coal 0.3 feet in thickness lying 91.3 feet above the base of the Pottsville were found ferriferous nodules, abundant plant remains, *Spirorbis pusillus* (Martin), *Lingula kanawhensis* Price, (abundant), *Naiadites elongata* Dawson and *Deltopectan flabellum* Price (abundant). This shale has been correlated by Hennen[16] with the Eagle Limestone and Shale of the Kanawha Valley and the small coal underlying it with the Little Cedar Coal. Hennen bases this correlation chiefly upon the resemblance of the 2-foot coal lying 20.7 feet above the so-called Little Cedar Coal in the Rowlesburg Section to the Eagle Coal of the Kanawha Valley which lies 90 to 100 feet above the Eagle Limestone and Shale at Eagle in Fayette County. In Webster and Randolph Counties the interval between the Eagle Coal and the fossiliferous Eagle Limestone and Shale has diminished to a thickness varying from

[15]West Virginia Geol. Surv., 1919, Fayette County Rept., p. 237.

[14]West Virginia Geol. Surv., 1918, Barbour, Upshur and west. por. Randolph Counties Rept., p. 288.

[16]In his republication of the Rowlesburg Section in the Report on Fayette County to which reference has been made above.

35 to 50 feet and is occupied chiefly by the Decota Sandstone which varies from 10 to 20 feet in thickness where it was exposed to view. The Eagle Shale has, however, not been traced through to Preston County as it has been found only as far north as the Elk River in Webster. As noted in this report, the only species which has been found in the Eagle Shale in Webster County is *Naiadites elongata* Dawson, except in the extreme western edge where marine fossils are reported by Reger. In the Rowlesburg Section no strata are found between the two fossiliferous beds which may satisfactorily be traced southward, the interval being occupied by a variety of black, gray, brown and green shales with a thin, siliceous limestone bed 2 feet thick. No limestone is noted by Reger in this portion of the section in Barbour and Randolph Counties to the south.

The exact correlation of the beds between the Hartridge Black Shale (according to the present interpretation) of the Rowlesburg Section and the Upper Connoquenessing Sandstone with those of the same interval in the area of the Report on Barbour, Upshur and Randolph Counties[17] is hardly possible from the data at present in hand. All the sandstone beds of this interval have disappeared before reaching the exposure west of Rowlesburg and only four coals remain (grouped into three beds by Hennen and Reger) of which only one attains a thickness of more than one foot. In Barbour and Upshur Counties 13 coal seams and 14 sandstone beds are found in this interval and three fossiliferous beds; namely, the Quakertown Shale, the Newlon Limestone and Shale, and the Eagle Shale. The correlation of the coal lying immediately beneath the Upper Connoquenessing Sandstone at Rowlesburg with the coal bed identified as the Quakertown Coal in Barbour and Upshur Counties, if correct, eliminates this horizon which, however, bears a fauna more nearly like that at Rowlesburg than does either the Newlon or the Eagle. The presence of *Lingula kanawhensis,* a marine species, leaves the probabilities in favor of the Eagle, at which horizon marine fossils appear in the region from southwestern

[17]See General Section of the Pottsville Series, p. 264, Barbour, Upshur and west. por. Randolph Cos. Rept.

Nicholas County southwestward across the Great Kanawha River, rather than the Newlon Shale which is, so far as known, a non-marine bed.

INVERTEBRATE FOSSILS COLLECTED FROM THE POTTSVILLE SERIES OF WEBSTER COUNTY.

Scope of the Investigation.—The writer has made only one collection of fossils from Webster County, namely, from the horizon of the Kanawha Black Flint on the line between this county and Nicholas. The other collections here described were obtained by Mr. D. B. Reger while gathering the data for the geologic and economic report of which this forms a part. Time did not permit as thorough an investigation of the fossil contents of the Pottsville Measures as was desired and it is believed by Mr. Reger that further studies in the field may reveal in Webster County others of the fossiliferous members of the Kanawha Valley region in addition to those which have so far been found.

In addition to the fossils submitted to the writer for study certain other occurrences of fossils are recorded by Reger, as noted in the description of the faunas.

In the description of species are included, in addition to those obtained from Webster County, descriptions of certain fossils not previously described which were collected in adjoining regions in Nicholas, Braxton, and Lewis Counties, and which have aided in the study of the Webster County specimens. The description of three species obtained from a landslip in Mingo County have been republished, with slight changes, from the Report on Fayette County[18] where they were described without accompanying illustrations. Several forms listed in the report on a collection of fossils from the Winifrede Limestone at Palmer, Braxton County[19], including two new species of annelids, are here described with illustrations of the new species.

[18]West Virginia Geol. Surv., 1919, Fayette County Rept., pp. 286 to 293.

[19]West Virginia Geol. Surv., 1917, Braxton and Clay Counties Rept., pp. 803 to 806.

Two tables showing the range and distribution of species have been prepared. In the table for Webster County only species from the county and from immediately adjacent areas are included. The collections from which these species were obtained have been studied for this report. All the species of each of these collections are here listed. In the table of species from other areas are listed the fossils obtained by Messrs. White, Hennen, and Reger from the Winifrede Limestone in Leslie County, Kentucky, those obtained by Hennen, Reger, and the writer from the Pottsville section exposed along the Baltimore and Ohio Railroad tracks west of Rowlesburg, Preston County, the species from Buffalo Creek near Chattaroy, Mingo County, listed in the Report on Fayette County, and, from localities of former reports, certain species which have not been included in previous lists. A specimen of *Serpulites* from a Nicholas County collection is included; the remainder of the fossils of this collection are to be studied for a forthcoming report on that county.

The writer is indebted to Dr. George Otis Smith, Director of the United States Geological Survey, for the opportunity of using the extensive collections of the Federal Survey for comparison with the specimens studied for this report and to Dr. George H. Girty, of the same organization, for his assistance in the use of the collections and for his kindly criticism and advice during the progress of the work. To Miss M. K. Sumner the writer is indebted for the preparation of the excellent half-tone illustrations which accompany the report.

FAUNAL HORIZONS.

The stratified rocks which outcrop in Webster County are of Quaternary, Pennsylvanian, and Mississippian ages. As shown by Reger in Chapter IV, deposits of Pleistocene age are found along certain river terraces but are not known to contain fossils.

The youngest formation of the Pennsylvanian System remaining in Webster County is the Conemaugh Series, a thickness of about 100 feet of strata of the lower portion of the series being the maximum recorded in the county. The

upper division of the Mahoning Sandstone is the youngest member of the Conemaugh seen by Mr. Reger. The fossiliferous horizons of the Conemaugh, the oldest of which is the Brush Creek Limestone coming 6 to 10 feet or more above the Upper Mahoning Sandstone, are thus apparently absent in Webster County.

The Allegheny Series is represented by 250 to 300 feet of strata which outcrop high on the ridges over a considerable area of northern and northwestern Webster. No fossils were observed in this series in the county and, indeed, with the exception of the Vanport Limestone fauna of the "Northern Pan-Handle" area of West Virginia, no fossils have been found in the Allegheny Series in the State.

Strata of Pottsville age cover most of the surface area of the county. Fossils have been found in six members of the Pottsville Series in Webster County. As the strata of this series are followed northward from the valley of the Great Kanawha River into Webster County many thin down and vanish, others are much reduced in thickness, and a few new beds appear.

Many of the fifteen or more fossiliferous beds of the series in Kanawha, Boone, Raleigh, Wyoming, and adjacent counties are not found in Webster and only two of the seven beds which there normally carry marine fossils —— namely, the Kanawha Black Flint and the Eagle Limestone and Shale —contain their usual assemblage of brachiopoda, pelecypoda and gastropoda. It is possible that further search may reveal other beds in Webster containing normal marine faunas, but undoubtedly many have vanished, the seas which the fossil animals once inhabited not having extended into the area of the county. Two fossil-bearing beds, the Kanawha Black Flint and the Hartridge Black Shale, are believed to extend into Barbour, Upshur, and Randolph Counties to the north. In Preston County, where the Pottsville strata have thinned down to a thickness of 330 feet in the exposure near Rowlesburg, only the Hartridge Black Shale is known to be fossiliferous; although a second fossiliferous bed found there may be the northward extension of the Eagle Shale which appears not to bear fossils in Barbour, Upshur, and Randolph

Counties. Neither in Webster County on the south nor in Preston on the north have fossils been found in either the Quakertown Shale of Barbour, Upshur, and Randolph Counties or in the Newlon Shale of Randolph County.

No strata of the Pocahontas Group of the Pottsville appear to be represented in Webster County.

Lying beneath the strata of the New River Group are the red shales, the sandstones and the limestones of the Mauch Chunk Series of the Mississippian. An account of this series and its three marine fossiliferous limestones and shale horizons is given by Reger in Chapter VIII of this report. No paleontological study of these beds has been made but two collections were obtained by Reger from the Terry Limestone at Localities Nos. 187 and 191[20].

Below the Mauch Chunk lies the Greenbrier Limestone Series, from 100 to 500 feet thick, containing numerous marine fossils. No investigation of the marine fossils of the Mississippian System has yet been undertaken by the Survey.

The Pocono Series and the upper portion of the Devonian have been penetrated by borings but do not reach the surface in Webster County.

The following table, adapted from the general section of the Pottsville Series by D. B. Reger given in Chapter VI of this report, exhibits the relationship and geologic position of the fossiliferous members of the Pottsville Series found in Webster County; the tentative correlations with the Pottsville formations of Pennsylvania and northern West Virginia proposed by Reger have been followed and the calculated positions, as determined by him, of the more important marine horizons of the Pottsville of southern West Virginia which were not found in Webster County are shown. Some of the latter may well be expected to be found in Webster when a more thorough search than has yet been undertaken may be prosecuted for them:

[20]See Register of Localities, below.

General Section of the Pottsville Series for Webster County Showing Fossiliferous Members.

	Thickness Feet	Total Feet
Kanawha Group (950′)		
Homewood Sandstone	25 to 75	75
Interval	80	155
Kanawha Black Flint horizon (Mercer Limestone of Pennsylvania?); dark shale frequently carrying marine fossils; at some localities a meager, and possibly non-marine, fauna is found	0 to 5	160
Interval	50	210
Quakertown Shale, black (not observed in Webster County)	0	210
Interval	20	230
Buffalo Creek Limestone (not observed in Webster County)	0	230
Interval	55	285
Winifrede Limestone, nodular, often represented only by dark shale; *Naiadites elongata* the only fossil form so far found in it in Webster County	0 to 5	290
Interval	40	330
Dingess Limestone, gray and hard, sometimes brown and siliceous; with marine fossils in northern Nicholas County (not observed in Webster County)	0	330
Interval	16	346
Seth Limestone, nodular, occurring in sandy shale; sometimes containing marine fossils (not observed in Webster County)	0	346
Interval	74	420
Campbell Creek Limestone, dark-gray, lenticular, seldom found in Webster County; containing obscure crustacean (?) remains	0 to 1	421
Interval	120	541
Newlon Limestone and Shale, dark, argillaceous and limy, non-marine, frequently replaces lower portion of Eagle Sandstone; contains *Naiadites elongata* in Randolph County	5	546
Interval	94	640
Eagle Limestone and Shale; dark, argillaceous shale with nodular limestone; numerous marine fossil species reported near Nicholas County line by Reger, elsewhere in Webster County *Naiadites elongata* the only fossil so far found in it	10 to 20	660
Interval	265	925
Douglas Shale, dark, sandy, laminated; not found to contain fossils in Webster County	5 to 13	938
Interval	12	950
New River Group (650′)		
Upper Nuttall Sandstone	30 to 80	1030

	Thickness Feet	Total Feet
Interval	252	1282
Skelt Shale, dark-gray; containing at its type locality a meager marine fauna consisting of *Orbiculoidea capuliformis, Naiadites elongata*, obscure gastropod (?) remains and ostracods	0 to 5	1287
Interval	38	1325
Hartridge Shale, dark, laminated, argillaceous, containing iron carbonate lenses, and plant fossils; Reger reports *Lingula* at three localities, elsewhere in Webster County known to contain only *Naiadites elongata* and plant fossils	5 to 20	1345
Sewell (Sharon? of Pennsylvania) Coal	2 to 5	1350
Interval	220	1570
Pineville Sandstone	0 to 30	1600
Mauch Chunk Series: red shales		

THE FAUNAS.

The following account of the assemblages of fossil species found in the several beds enumerated is not to be considered as furnishing a complete list of the life of the ancient seas which from time to time existed in Webster County. The investigation of the fossil remains has not been as full as is usually necessary in order to contain an approximately complete list of the species present. As has been previously noted, several horizons — namely, the Kanawha Black Flint, the Winifrede Limestone, the Campbell Creek Limestone, and the Eagle Shale of the Kanawha Group — are, in the regions lying to the south and southwest of the county, much more abundantly fossiliferous than they have been found to be in Webster and it is possible that other species than those here noted may have found their way into Webster County from the more populous regions of the seas in which they lived without having been obtained in the few collections studied.

Kanawha Black Flint.—The fauna of this horizon in Webster County is known chiefly from a single collection (Locality 203) from which twenty species and several indeterminate forms have been obtained. Five additional species have been found at other localities in strata which have been correlated by Reger with this horizon. Three distinct faunal phases are represented by these collections: At Locality 203

was found a large assemblage of marine species about one-third of which are characteristic of this horizon in the Kanawha Valley; these are more fully discussed below; at Localities 152, 188, and 197 were found two hardy species of inarticulate brachiopods, *Lingula carbonaria* and *Orbiculoidea capuliformis*, which frequently appear to have inhabited muddy areas apparently unfavorable to the normal marine fauna of the seas of the Kanawha Group. *Schizodus affinis* and certain undetermined pelecypod types are the only species accompanying the brachiopods in this phase, which may be distinguished as a restricted marine phase. At Localities 198, 194 and 193, respectively, were found plants, *Naiadites elongata*, and an assemblage consisting of the last-named species with *Spirorbis pusillus* and ostracods. These remains indicate deposition in fresh water or, in the case of the assemblage at Locality 193, a brackish-water or restricted marine phase. If the beds from which these collections were obtained lie at the same horizon, as correlated by Reger, the edge of the Kanawha Black Flint sea would appear to have passed through the area of Webster County with shallow and isolated basins of deposition alternating with others where the water was probably deeper and fresher or at least in more or less free communication with the seas. From the two phases described above the following species were collected:

Lingula carbonaria
Orbiculoidea capuliformis
Naiadites elongata
Schizodus affinis
Pelecypoda indeterminata
Ostracoda indeterminata
Plant remains

The normal marine phase, represented by the collection from Locality 203, referred to above, contains the following species:

Clinolithes canna
Hydreionocrinus mucrospinus
Crinoid column discs
Derbya crassa
Chonetes granulifer
Productus semireticulatus?
Marginifera wabashensis
Spirifer boonensis?
Spiriferina kentuckiensis
Composita subtilita

Chaenomya sp.
Edmondia gibbosa
Leda meekiana
Myalina swallowi
Schizodus affinis?
Schizodus cuneatus
Acanthopecten carboniferus
Pleurophorus sp.
Astartella concentrica?
Sphaerodoma? fusiformis
Gastropoda indeterminata 1
Orthoceras sp.
Pseudorthoceras knoxense
Ostracoda indeterminata

Of the species in the above list seven, possibly nine, have been previously found in the Kanawha Black Flint. Five of these are brachiopods which have a general range throughout the Kanawha Group. Five species; namely, *Chaenomya* sp., *Myalina swallowi, Acanthopecten carboniferus, Pleurophorus* sp., *Sphaerodoma? fusiformis* appear for the first time in the Pottsville Series of the State. Eight other species have not previously been reported in the Kanawha Black Flint but have been found in older members of the Kanawha Group. All except two of these, *Marginifera wabashensis* and *Spiriferina kentuckiensis,* have been found in strata younger than the Flint. The two species named, however, had previously appeared in West Virginia only in strata lying below this horizon. From the foregoing considerations it appears that the correlation of the fossiliferous stratum at Locality 203 with the Kanawha Black Flint of the Kanawha Valley rests upon stratigraphic grounds, the fossils furnishing no clear evidence either for or against such a correlation.

Winifrede Limestone.—Reger reports *Naiadites* at this horizon on Denison Run of Laurel Creek, 2.3 miles northeast of Cowen. A small collection from Locality 201, near Pugh, contained obscure remains the origin of which is uncertain. They are possibly of plant origin. The *Naiadites* shells probably indicate fresh-water conditions.

Campbell Creek Limestone.—At one locality obscure objects, possibly fragments of crustacean remains, were found. These are too indefinite to warrant an interpretation of the marine or non-marine origin of the deposits.

Eagle Limestone and Shale.—Collections from three lo-

calities considered by Reger to represent this horizon were found to contain only *Naiadites elongata,* probably indicating a fresh-water phase of this horizon. Reger reports numerous fossils of species common to this horizon in the Kanawha Valley at a point one mile northwest of Camden-on-Gauley on the road to Strouds. Where examined, over most of the county, marine fossils are absent at this horizon.

Skelt Shale.—This name has been applied by Reger to a stratum of dark shale lying above the Sewell "B" Coal and varying from a few inches to 5 feet in thickness. The following species were obtained from it in the only collection made:

Orbiculoidea capuliformis
Naiadites elongata
Gastropoda indeterminata 2
Ostracoda indeterminata

The presence of *Orbiculoidea capuliformis* reveals this as a marine fauna though of a very restricted type, similar to the restricted phase of the Kanawha Black Flint described above. This is the only collection of marine fossils from the New River Group which has been seen by the writer. Reger reports *Lingula* from the Hartridge Black Shale of Webster and Hennen reports shells of the same genus from the roof shales of several coal beds of this group in Fayette County.

Hartridge Black Shale.—Three collections from this horizon contain *Naiadites elongata* in abundance. A fourth collection contained only plant remains. Fresh-water conditions are thus indicated. Reger, however, reports *Lingula* in this shale on Gauley River and at two localities on Williams River, which would indicate marine water at these localities.

Restricted Marine Faunas.—Meager faunas such as have been noted above as occurring at certain localities in the Kanawha Black Flint, the Skelt and Eagle Shales, which are here termed *restricted faunas,* are of rather frequent occurrence in the Pottsville Series of this State. The species which have been noted by the writer in these assemblages in West Virginia are:

Spirorbis pusillus
Lingula carbonaria
Lingula kanawhensis
Orbiculoidea capuliformis
Orbiculoidea missouriensis
Myalina perniformis
Naiadites elongata
Schizodus affinis
Deltopecten flabellum
Allerisma guyandotensis
Plagioglypta meekiana?
Aclisina stevensiana
Aclisina conditi?
Coiled gastropod (?) shell-fillings
Crustacean (?) remains
Ostracoda
Fish scales
Plants

In the restricted faunas not more than a half-dozen species of the above list have been found at a single locality and at many points only a single species appears. The fossils are found in black, carbonaceous, sometimes cannelly, fine-grained, micaceous and, less frequently, sandy, shale, these characteristics being combined in a variety of ways; in at least one such collection some of the shells were partially pyritized.

It would appear that these faunas lived under conditions which were uncongenial to most of the marine types of the Pottsville seas or that they migrated into remote areas not reached by the other forms. *Lingula* is known to thrive on muddy bottoms under conditions unfavorable to other shallow-water types and it seems probable from the close association of the two that *Orbiculoidea* may have resembled *Lingula* in this particular. *Naiadites*, *Spirorbis* and ostracoda are known to have existed in a variety of habitats from marine to fresh waters. The frequent presence of plants with the marine species suggests near-shore conditions and probably quiet waters.

Thin-shelled pectenoids of the type of *D. flabellum* are frequent in these assemblages. Doctor Girty[21] reports having found similar shells in such an association and the writer has obtained *Aviculipecten rectilaterarius* in the Pennsylvanian of Maryland from a restricted fauna.

[21]In an oral communication.

Lingula and *Spirorbis* are among the so-called "immortal" types of Reudemann[22], of which these two range from the Ordovician to the recent. *Orbiculoidea,* ranging from the Ordovician to the Cretaceous, and *Aviculipecten,* from the Silurian to the Pennsylvanian, are "persistent" types. Many of the genera of fossil ostracods (26½%)[23] are such persistent forms. According to this author many of the persistent genera possess great vitality, while others are so generalized in their nature as to be adapted to live under a variety of environmental conditions. The above list of species of "restricted" assemblages would seem to contain such hardy or generalized types, many of which, as has been noted, are of geologically persistent or long-lived genera.

"Fresh-Water" Faunas.

Certain faunas have been here more or less tentatively classified as of fresh-water origin. In many cases this classification has been made with considerable uncertainty. Where plant leaves in abundance are accompanied by shells of *Naiadites elongata* it has been the writer's usage to classify the "fauna" as of fresh-water origin. When, however, *Spirorbis* and ostracods are also found the discrimination between fresh- and brackish-water origin became less clear owing to the poor preservation of the ostracoda which has prevented the recognition of the genera. However, the abundance and good state of preservation of the plant leaves has, in most cases, decided in favor of fresh water. When *Naiadites elongata* is found alone without plants it has not been possible to determine the origin because this species is also found associated with marine species, in restricted marine assemblages, and with plants. This occurrence has been tentatively classified as of fresh-water origin.

Geographic Variation of the Pottsville Faunas.—Although we have not, as yet, sufficient data for a study of faunal changes from point to point within the smaller fau-

[22]Reudemann, R., New York State Mus., 1917, Bull. No. 196, tables pp. 108-115.

[23]Idem, p. 115.

nules of the Pottsville throughout the State, yet certain broad relationships and differences between the faunas of the Kanawha, New River, and Pocahontas Groups may be drawn and certain general facts of geographic distribution may be pointed out.

In general, in the Pottsville strata of West Virginia, three types of faunas may be distinguished: (1) *the normal marine type,* (2) *a restricted marine type and* (3) *a fresh-water type.* The composition of these faunal types has been indicated in the foregoing discussion of the faunas of Webster County and of the "restricted" and "fresh-water" faunas.

In this State shells of the normal marine fauna are found in a variety of deposits ranging from sandy limestones through shaly and calcareous sandstones, shaly sandstones and light-colored shales to carbonaceous shales and limestones and black, aluminous chert. The restricted marine species are found chiefly in black, fine-grained shales which are in some localities cannelly while the fresh-water shells are found chiefly in the black, carbonaceous, fissile shale, the "slate" of the coal miner.

The Pocahontas Group is so far known to contain only *Naiadites elongata,* usually found with abundant plant remains, the deposits being interpreted as of fresh-water origin. The New River strata contain chiefly fresh-water forms with a few of the restricted marine faunas. The Kanawha Group contains all three types of faunas. In the Kanawha Valley and in the south central and southwestern counties the normal marine horizons are more numerous than those of the other two types. In Kentucky the Winifrede Limestone is reported by White, Hennen, and Reger as being 10 to 15 feet thick and highly fossiliferous, probably indicating increasingly marine conditions in the Kanawha Group to the west. Northward and northeastward in West Virginia many of the normal marine horizons disappear in the thinning down of the measures and at other horizons the normal marine faunas are replaced by restricted marine or fresh-water assemblages until, in Webster, Upshur and Barbour Counties, only one or two normal marine horizons are left and these disappear or change in faunal content to a restricted phase before the measures

reach the tops of the hills on the up-slope of the monoclinal structure of this region where their horizons pass into the air, the strata having been removed by the erosion of the uplifted plateau. In this region the restricted marine type and the fresh-water type of fauna are the most conspicuous phases.

At the northern border of the State in Preston County, only two horizons are found to contain fossils, at both of which restricted marine faunas appear.

RANGE AND DISTRIBUTION OF FOSSILS—WEBSTER COUNTY.

Abbreviations:—"aa", very abundant; "a", abundant; "c", common; "x", not more than a few specimens obtained.

	Kanawha Group												New River Group				
				Kanawha Black Flint				Winifrede Limestone	Campbell Creek Limestone	Eagle Shale			Kelt Shale	Hartridge Black Shale			
	152	188	197	203	192	194	198	201	196	189	190	204	200	192	195	199	202
Clinolithes canna Price				c													
Spirorbis pusillus Dawson					a												
Hydreionocrinus mucrospinus (McChesney)				x													
Crinoid column discs				x													
Lingula carbonaria Shumard	a	?															
Orbiculoidea capuliformis (McChesney)	x	x	x										x				
Derbya crassa (Meek and Hayden)				aa													
Chonetes granulifer Owen				aa													
Productus semireticulatus (Martin)?				x													
Marginifera wabashensis (Norwood and Pratten)				aa													
Spirifer boonensis Swallow?				aa													
Spiriferina kentuckiensis (Shumard)				c													
Composita subtilita (Hall)				a													
Chaenomya sp.				x													
Edmondia gibbosa (M'Coy)				x													
Leda meekiana Mark				x													
Myalina swallowi McChesney				c													
Naiadites elongata Dawson					c	x				c	?	c	c	a	a		x
Schizodus affinis Herrick	x			?													
Schizodus cuneatus Meek				x													
Acanthopecten carboniferus (Stevens)				x													
Pleurophorus sp.				x													
Astartella concentrica (Conrad)?				c													
Pelecypoda indeterminata		x															
Sphaerodoma? fusiformis (Hall)				x													
Gastropoda indeterminata 1				c									c				
Gastropoda indeterminata 2																	
Orthoceras sp.				x													
Pseudorthoceras knoxense (McChesney)				x													
Ostracoda indeterminata				x	a								x				
Crustacea? indeterminata									x								
Plant remains							x										
Obscura (plants?)								x								x	

RANGE AND DISTRIBUTION OF FOSSILS FROM OTHER AREAS.

Abbreviations:—"aa", very abundant; "a", abundant; "c", common; "x", not more than a few specimens obtained.

	Ames Limestone	Kanawha Group									
		Kanawha Black Flint	Buffalo Creek Limestone	Land Slip. Horizon Unknown	Winifrede Limestone				Dingess Shale	Eagle? Shale	Hartridge Black Shale
	90	106	176	177	139	A	B	C	151	207	208
Clinonolithes canna Price							x				
Serpulites sagittifer sp. nov.		x		x	c				x		
Spirorbis pusillus (Martin)										c	
Gnatholites productus sp. nov.					x						
Hydreionocrinus mucrospinus (McChesney)	x										
Eupachycrinus tuberculatus Meek and Worthen	x										
Crinoid column discs						x					
Bryozoa (foliate)							x				
Bryozoa (dendroid)							x				
Lingula kanawhensis Price										a	a
Lingula lemniscata Price				aa							
Orbiculoidea missouriensis (Shumard)				c							
Orbiculoidea capuliformis (McChesney)							x				
Derbya crassa (Meek and Hayden)						x	x				
Derbya? sp.								x			
Chonetes granulifer Owen				x		x	x	x			
Productus semireticulatus (Martin)?						x	x				
Pustula symmetrica (McChesney)?							x				
Pustula sp.						x					
Marginifera wabashensis (Norwood and Pratten)				x							
Spirifer boonensis Swallow?			x			?					

RANGE AND DISTRIBUTION OF FOSSILS FROM O THER AREAS—CONTINUED.

Abbreviations:—"aa", very abundant; "a", abundant; "c", common; "x", not more than a few specimens obtained.

	Ames Limestone	Kanawha Group									Hartridge Black Shale
		Kanawha Black Flint	Buffalo Creek Limestone	Land Slip. Horizon Unknown	Winifrede Limestone				Dingess Shale	Eagle? Shale	
	90	106	176	177	139	A	B	C	151	207	208
Spirifer? sp.								x			
Composita sp.							x				
Solenomya radiata Meek and Worthen				x							
Nucula parva McChesney?				x							
Myalina swallowi McChesney							x			x	
Naiadites elongata Dawson				aa							
Naiadites carbonaria Dawson?							x				
Naiadites? sp.				x							
Aviculipecten pellucidus Meek and Worthen							x				
Acanthopecten carboniferus (Stevens)							x	x		a	
Deltopecten coxanus (Meek and Worthen)				x							
Deltopecten flabellum Price					x			x			
Deltopecten sp.				aa							
Deltopecten sp.					x						
Allerisma terminale Hall						x					
Pleurophorella sesquiplicata Price				x							
Cypricardinia? carbonaria Meek?						x	x				
Astartella concentrica (Conrad)				x							
Patellostium montfortianum (Norwood and Pratten)				a							
Phanerotrema grayvillense (Norwood and Pratten)						x					
Bulimorpha nitidula (Meek and Worthen)?				x							
Gastropoda indeterminata				x							
Orthoceratida indeterminata				x							
Nautilloidea? indeterminata							x			c	
Ostracoda indeterminata				c							
Plant remains											

Register of Localities.

The following list includes the localities from which fossils have been collected in Webster County with one locality in Braxton near the Webster County line. An asterisk (*) denotes that the collection has been studied for this report:

152 *Webster County, Glade District, on the line between Webster and Nicholas Counties, in a small, right-hand branch of Barnet Run near the head of the run and 1.8 miles south of Boggs P. O., Webster County: elevation, 2070′ B. Kanawha Group, KANAWHA BLACK FLINT. Collectors, D. B. Reger, and W. Armstrong Price.

187. Webster County, Fork Lick District, Left Fork of Leatherwood Creek, 3.5 miles southeast of Bergoo village; elevation, 2589′ B. Mauch Chunk Series, TERRY LIMESTONE. Collector, D. B. Reger.

188. *Webster County, Holly District, 0.4 mile north of Salisbury Station; elevation, 1720′ B. Kanawha Group, KANAWHA BLACK FLINT. Collector, D. B. Reger.

189. *Webster County, Holly District, West Virginia Midland R. R. east of Elk River, 0.3 mile northwest of Tracy Switch; elevation, 1755′ B. Kanawha Group, EAGLE SHALE. Collector, D. B. Reger.

190. *Webster County, Holly District, 0.5 mile north of Jumbo, in public road on Desert Fork of Left Fork of Holly River; elevation, 1740′ L. Kanawha Group, EAGLE SHALE. Collector, D. B. Reger.

191. Webster County, Fork Lick District, north side of Gauley River, 1.0 mile westward from mouth of Turkey Creek; elevation, 2348′ B. Mauch Chunk Series, TERRY LIMESTONE. Collector, D. B. Reger.

192. *Webster County, Fork Lick District, Little Run of Elk River, 1.5 miles southwest of Waneta; elevation, 2824′ B. New River Group, HARTRIDGE BLACK SHALE. Collector, D. B. Reger.

193. *Webster County, Hacker Valley District, Left Fork of Holly River, 0.4 mile northeast of Poling; elevation, 1610′ B. Kanawha Group. KANAWHA BLACK FLINT. Collector, D. B. Reger.

194. *Webster County, Hacker Valley District, public road east of a short branch of Right Fork of Little Kanawha River, 0.8 mile south of Cleveland; elevation, 1640′ B. Kanawha Group, KANAWHA BLACK FLINT. Collector, D. B. Reger.

195. *Webster County, Holly District, east side of Elk River, 0.4 mile west of Summit Station; elevation, 1237′ B. New River Group, HARTRIDGE BLACK SHALE. Collector, D. B. Reger.

196. *Braxton County, Holly District, south side of Lick Creek of Laurel Creek, at Custis; elevation, 1091′ B. Kanawha Group, CAMPBELL CREEK LIMESTONE. Collector, D. B. Reger.

197. *Webster County, Holly District, south side of Elk River, 1.2 miles southwest of Tracy Switch; elevation, 2345′ B. Kanawha Group, KANAWHA BLACK FLINT. Collector, D. B. Reger.

198. *Webster County, Fork Lick District, on a branch of Grassy Creek, 0.7 mile northeast of Kovan; elevation, 2273′ B. Kanawha Group, KANAWHA BLACK FLINT. Collector, D. B. Reger.

199. *Webster County, Holly District, Gulf Run of Elk River, 3.7 miles east of Centralia; elevation, 1059′ B. New River Group, HARTRIDGE BLACK SHALE. Collector, D. B. Reger.

200. *Webster County, Holly District, on north side of Sugar Creek, 0.3 mile west of mouth of Little Sugar Creek; elevation, 2043′ B. New River Group, SKELT SHALE. Collector, D. B. Reger.

201. *Webster County, Hacker Valley District, west of Left Fork of Holly River, in public road, 0.3 mile northwest of Pugh; elevation, 1715′ B. Kanawha Group, WINIFREDE LIMESTONE. Collector, D. B. Reger.

202. *Webster County, Glade District, northwest of mouth of Whiteoak Fork of Williams River; elevation, 2513′ B. New River Group, HARTRIDGE BLACK SHALE. Collector, D. B. Reger.

203. *Webster County, Holly District, west of Grassy Creek, and 0.8 mile northeast of Summit Station; elevation, 2015′ B. Kanawha Group, KANAWHA BLACK FLINT. Collector, D. B. Reger.

204. *Webster County, Hacker Valley District, 0.8 mile south of Hodam, in public road west of Hodam Creek; elevation 1825′ B. Kanawha Group, EAGLE SHALE. Collector, D. B. Reger.

The following localities (with the exception of Locality 151, one fossil from which is included in this report) have been recorded in previous reports but are repeated here for convenience of reference. At Localities 90, 106, and 139 many other species were obtained, in addition to those listed and described in this report, and have been recorded in previous reports:

90. *Lewis County, Hackers Creek District, hillside at Jackson Mill above tracks of Monongahela Valley Railroad; elevation, 1125′ B. Conemaugh Series, AMES LIMESTONE. Collector, W. Armstrong Price.

106. *Lewis County, Collins Settlement District, west bank of Glady Creek, 1.1 miles north of Bablin; elevation 1085′ B. Kanawha Group, KANAWHA BLACK FLINT. Collectors D. B. Reger and W. Armstrong Price.

139. *Braxton County, Holly District, east of Elk River 0.25 mile north of mouth of Holly River and 100 feet west of West Virginia Midland Ry. station at top of cut and 20 feet above railway grade. Kanawha Group, WINIFREDE LIMESTONE. Collector, W. Armstrong Price.

151. *Nicholas County, Jefferson District, Lick Branch of Open Fork of Bells Creek, west side of branch, 1.2 miles northeast of Dixie. Kanawha Group, DINGESS SHALE. Collectors, D. B. Reger and W. Armstrong Price.

176. *Mingo County, Hardee District, hillside southeast of mouth of Buffalo Creek and south of town of Chattaroy; elevation, 1155' B. Kanawha Group, BUFFALO CREEK LIMESTONE. Collector, W. Armstrong Price.

177. *Mingo County, Hardee District, hillside north of Buffalo Creek in a landslip by side of plane of Buffalo Collieries Co. mine (foot of plane being 0.8 mile northeast of mouth of creek); elevation, 1143' B. Kanawha Group, HORIZON NOT DETERMINED. Collector, W. Armstrong Price.

207. *Preston County, Reno District, west side of Cheat River at Baltimore and Ohio R. R. grade about 300 yards north of the crossing of Buckhorn Run; 479 feet stratigraphically below the top of the Upper Freeport Coal in the Rowlesburg Section, West Virginia Geol. Sur., 1914, Preston Co., Rept., p. 98. Pottsville Series, Kanawha Group (?), EAGLE SHALE (?). Collectors, Ray V. Hennen, D. B. Reger, and W. Armstrong Price.

208. *Preston County, Reno District, west side of Cheat River at Baltimore and Ohio R. R. grade about 300 yards north of the crossing of Buckhorn Run; 504 feet stratigraphically below the top of the Upper Freeport Coal in the Rowlesburg Section, West Virginia Geol. Surv., 1914, Preston Co., Rept., p. 99. Pottsville Series, New River Group, HARTRIDGE BLACK SHALE. Collectors, Ray V. Hennen, D. B. Reger and W. Armstrong Price.

Fossils collected from three localities in Kentucky have been studied for this report, numerals not being assigned to the collections:

A. *Leslie County, Kentucky, exact location not recorded. Kanawha Group, WINIFREDE LIMESTONE. Collectors, I. C. White, Ray V. Hennen, and D. B. Reger.

B. *Leslie County, Kentucky, on Peter Branch of Wolf Creek, Kanawha Group, WINIFREDE LIMESTONE. Collectors, I. C. White, Ray V. Hennen, and D. B. Reger.

C. *Leslie County, Kentucky, on Coon Creek, Kanawha Group, WINIFREDE LIMESTONE. Collectors, I. C. White, Ray V. Hennen, and D. B. Reger.

DESCRIPTION OF SPECIES.

(The following abbreviations are used in the descriptions: "a", abundant; "aa", very abundant; "c", common: where no symbol follows the locality number the species is rare in the collection obtained. All the specimens here described are in the collection of the West Virginia Geological Survey.)

VERMES.

CHAETOPODA

TUBICOLA

Genus SERPULITES MacLeay.

To this genus have been referred tubes of a variety of form. That they represent a single genus seems unlikely. It is, however, not proposed at this time to attempt a revision of all described species of the genus but to call attention to certain structures characteristic of the type species, *S. longissimus*, and, consequently, of the genus *Serpulites (sensu stricto)*, which seem to have been overlooked or disregarded by some writers.

As described in various paleontological treatises, *Serpulites* seems to consist of smooth, arcuate, glossy, tubular fossils which sometimes reach a length of a foot with a diameter of an inch; in the most typical forms the tube exhibits two small, longitudinal ridges, or cylindrical ribs, placed at opposite points of the circumference and usually marginal; between the ribs the test appears to be flexible and is frequently broken away, leaving the ribs partially imbedded in the matrix; tests "slightly calcareous" or chitinous, more or less distinctly marked by undulating annulations. According to some[24] "these thickened borders (ribs) do not appear to be constantly present." Geologic range: Ordovician to Pennsylvanian.

One writer[25] has described fragmentary, flattened, chitinous tubes bearing marginal ribs, which were found associated with a branching organism whose elements were composed of similar tubes. He refers the single, fragmentary tubes to "the *Serpulites* of Murchison" and suggests the identity of these with the branching organism and the classification of both with the hydroids.

Perhaps considering the longitudinal cylindrical ribs, which form a prominent feature of the type species, to be variable in their appearance, some have omitted reference to these struc-

[24]Nicholson, H. A., and Lydekker, R., Manual of Pal., 3rd. ed., 1889, Vol. i, p. 475.

[25]Clarke, J. M., 1913, Serv. Geol. e Min. do Brazil, Mon. i, p. 85, pl. xxvi, fig. 15; and p. 319, pl. xxvi, figs. 16-18.

tures in summarizing the characters of the genus[26] and others have assigned to the genus species in which the ribs are apparently not known to have been developed.[27]

Other chitinous shells bearing internal rod-like bodies have been referred to *Enchostoma* Miller. An examination of authentic specimens of *E. lanceolatum*[28], the type species of the genus, indicates that these rods were not present in this species, nor is the feature mentioned by Miller as being found in his specimens. *Enchostoma* appears to resemble MacLeay's genus in all features except the absence of the ribs and it seems proper, therefore, to transfer to *Serpulites (sensu stricto)* those species of the former genus which lack these structures.

The following revision of the species which have been referred to *Enchostoma* has been made after a study of available material, including, with the exception noted, either the type and figured specimens or authentic material from the vicinity of the type locality:

Genus ENCHOSTOMA Miller.

Enchostoma lanceolatum (Miller). Genotype; Chouteau Limestone, Missouri; first described from a frament and referred to *Hyolithes;* the genus *Enchostoma* erected for it when additional material showed it to possess a shell differing in texture from those of *Hyolithes;* marginal ribs not described by Miller and plainly absent in specimens from the vicinity of the type locality; upon these shells annulations of the test plainly marked (an obscure reference by Miller to several fragments with "longitudinal fluting" is worthy of note but not described as upon typical *lanceolatum*).

Enchostoma serpuliforme Girty. Wewoka Formation, Oklahoma; thread-like, black, phosphatic tubes wound around the shell of an *Orthoceras.* Their reference to *Enchostoma* by Doctor Girty was rather provisional because of their small size and attached habit. They exhibit no marginal ridges; annulations observed upon one fragment.

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[26]Hinde, G J., in Text-book of paleontology, Eastman-Zittel, Second ed., 1913, p. 139.

[27]Dawson, Acadian Geology, Second ed., 1868, p. 312, figs. 130 and 131.

[28]Miller, Geol. Surv. Indiana, Adv. Sheets 18th. Rept., 1892, p. 63, pl. ix, figs. 35 and 36. Chouteau Limestone, Sedalia, Missouuri; specimens from the vicinity of Sedalia, have been available for study, through the kindness of Prof. Stuart Weller, of the Walker Museum, University of Chicago.

Enchostoma sp. Girty. Weber Limestone, Colorado; specimens not examined by the writer; retained in this genus, as marginal ribs were not noted by Doctor Girty although the specimens are flattened into ribbons.

Genus SERPULITES MacLeay (s. s.)

Serpulites bicarinatus (Girty). Moorefield Shale, Arkansas; well-marked, marginal ridges; cones of small size, flattened into ribbons; median portions of the tests broken away; annulations not seen; ribs approximately one-eighth of the width of the flattened tube in diameter.

Serpulites sagittifer sp. nov. Kanawha Group, West Virginia; ribs tion, West Virginia; known only from fragmentary cones and impressions; marginal ridges present upon the impression of the under side of the holotype but not upon the upper surface of the short length of test preserved, hence, apparently impressed upon the exterior of only one side of the flattened test; ribs one-third to one-fourth (?) the width of the flattened tube.

Serpulites sagittifer sp. nov. Kanawha Group, West Virginia; ribs plainly marked, about one-third the width of the oval tube in diameter; in one specimen the internal structure plainly visible, the ribs appearing as cylindrical rods composed of various minerals; annulations marked; cone more slowly enlarging than that of *S. elkensis.*

Serpulites sp. (Girty). Wewoka Formation, Oklahoma; ribs plainly marked, diameter of ribs one-fifth the width of the flattened tube, otherwise closely resembling *S. sagittifer*; annulations visible.

The physiological significance of the pair of internal rod-like bodies is not clear to me. A specimen of *Serpulites sagittifer* in our collections exhibits the regions of the rods partly occupied by deposits of various materials and partly vacant, the crystalline filling having been removed by leaching[29]. In this specimen the test is flattened into a narrow, elongate-oval cross-section and broken into two pieces, the surface being much wrinkled and portions of the test broken away, exposing the interior of the tube. It is thus possible to view both a part of the interior of the tube itself and the materials which fill it. Within the horny test the marginal areas are occupied by two cylindrical rods composed of various materials while the median portion — in thickness about one-third the long diameter of the elliptical cross-section — is filled with a dark, structureless material not unlike that of the matrix of the fossil. One of the two cylindical areas may be followed

[29]See Plate xxxiv, Figs. 1-3.

throughout the entire length of the specimen as a differentiated zone, constituted, beginning at the smaller end, as follows: About four-millimeters' length of a mineral with a silvery metallic lustre and cubical cleavage much resembling galena; a gap of two millimeters where the tube is broken away; two-millimeters' length of a mass of tiny white crystals of vitreous lustre; finally, seven-millimeters' length from which the filling of the cylinder has been largely removed, probably by leaching, leaving only traces of the white vitreous mineral. Near the ends of the cylinder are two grains of a yellow mineral resembling pyrite. At least two-millimeters' length of the other cylinder is filled with a light-brown, granular substance which seems to contain some crystalline matter. From an examination of this specimen it is plain that tubes of this species, at least, may contain the internal rod-like structures without the fact being apparent from an examination of the exterior unless the cone is sufficiently flattened to reduce its thickness to that of the cylindrical rods, or less than this amount, or unless the test were broken through, disclosing the differentiation of the shell-filling. On the other hand, it is equally clear that the test can not be flattened beyond the amount stated without the rigidity of the internal cylinders becoming apparent through the flexible test. Until more is known of the significance and origin of these cylindrical structures the possibility must be entertained that they might in some cases be filled with material no more rigid than that of the matrix, when flattening would not reveal their presence. The cross-section, Fig. 2, Pl. xxxiv, shows a part of one rod to be partly missing, the area of the missing part being occupied by the material of the matrix with no line of demarcation visible. The other rod is here slightly out of its usual marginal position and is separated from the test by the material of the matrix, which fact suggests that the rods were partially broken and dislocated before consolidation of the rock.

The presence of these rod-like structures seems to indicate a definite life process the action of which resulted in their formation. What this process was, or how the pair of inner, tubular areas became filled with the materials found in the

specimen just described are matters largely speculative. As to the nature of the cylindrical bodies two possibilities suggest themselves; either that the animal during its lifetime deposited material along the inner margins of its test in two subcylindical rods, after the analogy of the marginal deposits within the chambers of certain nautilloids, or that the rods represent tubular portions of the animal body originally composed of, or filled with, materials different in composition or structure from the remainder of the soft parts. No analogous structures in the bodies of living annelids are known to the writer and the theory of marginal deposits seems the more reasonable one. In the case of the specimen with the rods composed of crystalline materials it is supposed that the original marginal deposits were chemically replaced by mineral matter in solution in the water which saturated the sediments when the tube was entombed, no evidences having been observed of a later mineralization of the strata in the region in which the specimen was obtained.

Tubes of minute diameter are associated with the larger cones at one locality from which the writer has obtained specimens of *Serpulites* and a similar occurrence has been reported by Doctor Girty in the case of the *S. sp.* from Oklahoma. Whether these minute tubes represent the early, posterior portion of the larger cones or should be regarded as belonging to other species is not certain. The writer is, however, inclined to the former view. These minute cones in several instances lie in positions in the matrix suggestive of branching. There is no positive evidence of branching and accidental juxtaposition by drifting of the cones would account for the observed association.

The relation of *Enchostoma* Miller to *Serpulites* would seem to rest upon the propriety of assigning a generic value to the presence of internal rods in *Serpulites* and upon the

scope which may be assigned to that genus after a revision of the rather heterogeneous cones which have been referred to it[29a].

Serpulites sagittifer sp. nov.

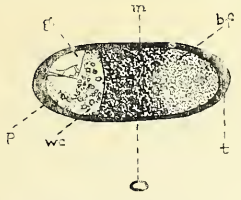
Plate xxxiv; figs. 1-4.

Description.—Narrow, tapering, chitinous cones with fairly regular annulations consisting of slightly raised or depressed bands marked off by fine, closely placed lines upon the surface of the otherwise smooth, polished test; test composed of several concentric lamellae; cones slightly curved, and usually flattened into a ribbon, when two rigid, marginal bands appear which denote the presence of two internal, marginal, rod-like structures which support the test at the margins above the central portion which is usually much wrinkled and often broken by pressure. In cross-section the cone seems to have been subcircular to oval. Anterior and posterior terminations unknown. Cones apparently free. Rods about one-third the width of the preserved portions of the shell.

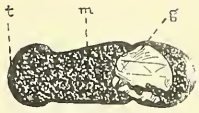
Dimensions of several cone fragments:

Locality No.	Length mm.	Breadth mm.	Curvature mm.	Diameter of Rods mm.	Cross-Section
139	47	1.5 to 3.5	1.0	0.5	Ribbon
139	16	1.0 to 1.5	1.0	Less than 0.5	Circular to oval
139	14	0.25			Circular
139	12	0.25			Circular
177	16	2.00			Ribbon
151	12	1.00			Ribbon
106	20	2.25 to 3.0		0.7	Elongate—oval 1 mm. thick

[29a]The genus *Serpulites* is often erroneously credited to Murchison. Since writing the above we have seen two papers by Reudemann in which he points out certain resemblances between *Conularia* and *Serpulites*, namely, the constitution of the tests, the possession of terminal discs, transverse wrinkles and marginal thickenings. He also redefines the genus *Serpulites*, eliminating certain species and describing others from the Ordovician, Devonian and Mississippian rocks, and noting the occurrence of the genus in the Clinton. Reudemann, R., 15th Ann. Rept., N. Y. State Geol., 1895, pp. 690-728; and N. Y. State Mus., Bull. No. 189, 1916, pp. 83-89.



1



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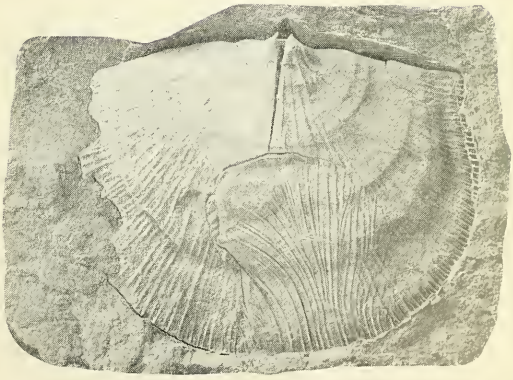

9

M. K. Sumner and W. A. Price, dels.

POTTSVILLE FOSSILS.

The internal rod-like structures and a case of pseudo (?) branching of tubes have been described in discussing the genus.

Associated with larger cones at one locality[30] are thread-like cone imprints showing annulation but no marginal ridges. Similar cones of small diameter are reported by Doctor Girty as associated with the very closely related form designated by him as *Enchostoma* sp. (here referred to *Serpulites*) from Oklahoma. He suggests that they are either representatives of another species, *Enchostoma serpuliforme*, or "only immature forms of the same species, but if so the organism must have been extremely long for the size of the tube." The present writer is inclined to the view that these smaller tubes represent earlier-formed portions of the larger tubes, several of which taper to minute diameters where they are broken without exhibiting their distal terminations.

This species, as represented by the known examples, is intermediate in size between *S. bicarinatus* and *S. elkensis*[31]; from the latter it differs in its more gradually tapering tube which, in the specimens from West Virginia, does not exceed in width one-half that of *elkensis*. The width of *S. bicarinatus* appears not not to exceed, in the known examples, one-half that of *S. sagittifer*. There is an increasing tendency to rapid expansion of the tubes in length as we pass from the narrow *bicarinatus* to the broader *elkensis*. The internal rods are relatively larger in *S. sagittifer* than in the two other species. From *Serpulites* sp. Girty from Oklahoma it differs in having

[30]Locality 139.

[31]*S. elkensis* is known from only two specimens, the holotype from Locality 40, Kanawha County, and from a specimen from the Brush Creek Limestone horizon, Locality 99, in Lewis County, West Virginia. An indefinite, worm-like cast with the impression of a portion of its upper surface has been noted in a collection from Lewis County, (West Virginia Geological Survey, 1916, Lewis and Gilmer Counties, Rept., p. 636, Locality 91) and was designated as "*Enchostoma?* sp. or rootlet?" This affair is of irregular cross-section and shows a rude segmentation, but the absence of all traces of a test, with its indefinite form, will not permit its reference to the annelida. It suggests a flattened and desiccated plant root but its origin is obscure.

proportionally thicker ribs, but otherwise the two forms closely resemble each other.

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT. Lewis County, Locality 106, upper portion Kanawha Group, HORIZON NOT DETERMINED, Mingo County, Locality 177; WINIFREDE LIMESTONE, Braxton County, Locality 139 (c); DINGESS SHALE, Nicholas County, Locality 151.

Genus SPIRORBIS Daudin.

Spirorbis pusillus (Martin).

Conchyliolithus (Helicites) pusillus. Martin, 1809, Petref. Derbiensia, pl. lii, figs. 2, 3.

Description.—Imperfectly preserved tubes and internal molds of the volutions of this little species are found in fine-grained, black shales either free or partly imbedded in shells of *Naiadites elongata, Deltopecten flabellum* and plant leaves. Associated at one locality with *Deltopecten flabellum,* plant leaves and *ostracoda.*

Whether the tubes associated with pelecypod shells and plant remains were actually attached to them or were merely pressed into them by the weight of overlying strata, as has clearly happened to tiny ostracod shells at one locality, is not clear.

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT, Webster County, Locality 193 (a); EAGLE SHALE (?), Preston County, Locality 207 (c).

ERRANTIA.

Genus GNATHOLITES gen. nov.

The structure here described as *Gnatholites productus* is believed to be the paired jaws of a polychaetous annelid. It differs, so far as the writer has been able to ascertain, sufficiently from described jaws of recent and extinct worms to warrant the employment of a new generic name for its classification.

The jaw combines features found in those of a number

of modern and paleozoic genera. From *Nereis* and allied modern genera it differs in having the large, terminal hook curved anteriorly until it points in a direction at right angles to the long axis of the jaws. In *Nereis* the terminal hook is, in nearly all described species of the genus, pointed forward[32] and there are from four to eight small "teeth." Anteriorly it resembles jaws of the paleozoic genus *Arabellites* in the curvature of the terminal hooks, but differs from them in having a single small "tooth" posterior to the terminal hook and in the configuration of the posterior portions of the jaw. In the latter region the jaw resembles those of *Nereis* and the paleozoic genus *Nereidavus* in possessing a posterior prolongation, bounded by a ridge, to which the muscles appear to have been attached. This posterior region is not preserved entire in the single specimen found.

The jaws are of minute size, black in color, polished, and probably chitinous. From their general resemblance to jaws of *Nereis* it might, with some propriety, be inferred that it had been borne by a free-swimming, predaceous annelid of the order *Errantia.* It was, on the other hand, obtained from a stratum of black shale at the same level in the formation with, and not more than a few feet from, tubes of *Serpulites sagittifer* sp. nov. The latter appears to have its closest relatives among the sedentary annelids of the order *Tubicola.* It is not impossible that the jaw belonged to the inhabitant of one of these tubes, although the tubicolous annelids are generally considered to have lacked jaws. In common with other detached annelid jaws its position in the animal kingdom must remain largely inferential unless jaws be found attached to the animal body.

Etymology; Greek, *gnathos,* jaw, and *lithos,* a stone.

Genotype; *Gnatholites productus.*

Gnatholites productus sp. nov.

Plate xxxiv, fig. 5.

Description.—A single example of a pair of minute, polished, black, chitinous jaws not attached to other structures

[32] *N. kobiensis,* Challenger Expd. Repts., vol. xii, Zool., pl. xxxiv, fig. 6.

but lying in close juxtaposition in the matrix apparently just as they were when held in position by the muscle tissue of the animal, the tips of the terminal hooks and the bases of the jaws being approximate. Terminal hook of each jaw curved so as to point in a direction at right angles to the diameter of the jaws, one hook being slightly less curved than the other. Posterior to the terminal hook on each jaw is a single, shorter barb or "tooth" situate on the inner edge of the jaw and set a little forward of the mid-point of the cutting edge. Inner edge of jaw, between the terminal hook and the small "tooth," crescentic in outline and narrowly rounded; posterior to the small "tooth" it is more nearly knife-like, the edges of the jaws sloping to meet each other at their bases; sides of jaws convex, thickened along the middle and bluntly carinate; outer edges rounded.

Posteriorly, only one of the two jaws is sufficiently well-preserved for the configuration of this portion of the remains to be clearly deciphered; at the base of this jaw a deep furrow cuts diagonally across from the lateral margin toward the point of approximation of the cutting surfaces, thus separating from the rest of the jaw a wedge-shaped lobe which was apparently continuous with a flat, posterior prolongation which is produced backward for a distance greater than one-half the length of the jaws. This process appears to have been set in the muscle tissue of the animal and the diagonal furrow at the base of the jaw may have served for the attachment of muscles. The truncated base of the other jaw indicates the former presence of a similar furrow and lobe on this jaw.

Greatest width of the jaw near the base; jaws equal in size and very nearly alike in configuration.

Length of cutting surface, 1.5 mm.; total length, apparently, 2.5 mm.; distance across the two jaws, 1.3 mm.; greattes width of a single jaw, 0.5 mm.

With its single small "tooth," not approaching in form any described fossil species known to the writer; relationships discussed in the description of the genus.

Occurrence.—Kanawha Group, Kanawha Black Flint, Braxton County, Locality 139.

ECHINODERMATA.

CRINOIDEA

Genus HYDREIONOCRINUS De Koninck.

Hydreionocrinus mucrospinus (McChesney)

Zeacrinus mucrospinus. McChesney, 1860, Descr., New Pal. Foss., p. 10, (and plates illustrating the same, 1865, pl. iv, figs. 7a, b.

Coal Measures: Carlinville, Macoupin County, Illinois; Sanmon County, Illinois; mouth of Rush Creek, Indiana.

Description.—The mold of the exterior of the upper side of a small spine is the only evidence of the presence of this species[33]. The spine is practically a replica of the figure of a spine of this species illustrated by Meek and Worthen[34] from the roof shales of the "No. 8" coal at Springfield, Illinois, and "various other localities in the Upper Coal Measures of Illinois."

A thickening at the upper end of the small vertical ridge near the base of the spine is the only difference which has been discerned in our specimen from the illustration cited.

This species, according to Meek, "has its second primary radial pieces produced outward into long spines." The spine in our collection shows the upper side which supports the "two first divisions of the arms," Meek, 1871.

Dissociated discs from the columns or arms of crinoids were found at the same locality and may belong to this or to other species.

Occurrence.—Conemaugh Series, Ames Limestone, Lewis County, Locality 90. Kanawha Group, Kanawha Black Flint, Webster County, Locality 203.

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[33]That is, in Webster County. A spine of the same pattern, not so perfectly preserving the sculpture of the basal portion but apparently belonging to the same species as this, has been found in a collection from the Ames Limestone of Lewis County (Locality 90, W. Va. Geol. Surv., Lewis and Gilmer Cos. Rept., 1916, p. 628). With this spine were found plates of two or more species of crinoids, among which are several belonging to *Eupachycrinus tuberculatus* Meek and Worthen.

[34]Geol. Surv. Illinois, 1873, vol. v, p. 563, pl. xxiv, fig. 12a.

MOLLUSCOIDEA.

BRACHIOPODA.

Genus LINGULA Bruguière.

The relationship of the several types of this genus recognized among the specimens collected in West Virginia which had been studied by the writer previous to August 1916 were discussed in a report on Raleigh County fossils[35]. Since that time other collections have been studied, including those of the present report, and it appears that the conclusions formerly expressed should now be somewhat modified.

Specimens of *Lingula* with a subelliptical shape, having the anterior and posterior ends approximately alike in outline, have been referred to *L. umbonata* Cox, following White and others who evidently considered Cox's figured specimen to have been an immature example of the commoner form figured by them. It seems, however, best to follow Girty[36] in referring shells of this type to *L. carbonaria* Shumard illustrated by Meek and Worthen under the name of *L. mytiloides?*[37]. Cox's illustration shows a minute form with a subpentagonal outline, rounding posteriorly, tapering anteriorly and with a truncated anterior margin. Cox states that his species "attains a much greater size" than the figured specimen.

Shapes intermediate in form between *L. kanawhensis* Price and *L. umbonata* Cox have been figured by the writer[38]. Two of these shells taper slightly anteriorly, suggesting *L. umbonata,* but one is rounded rather abruptly and is almost subtruncate posteriorly and the other tapers bluntly to the umbo. The former (from Wyoming County) was found as-

[35]West Virginia Geol. Surv., 1916, Raleigh and west. por. Summers and Mercer Counties Rept., p. 690.

[36]Girty, G. H., U. S. Geol. Surv., 1915, Bull. 544, p. 49.

[37]Meek and Worthen, Geol. Surv. Illinois, 1873, vol. v. p. 572, pl. xxv, figs, 2a, 2b, 2c.

[38]West Virginia Geol. Surv., 1916, Raleigh and west. por. Summers and Mercer Cos., 1918, Rept., p. 691, pl. xxx, fig. 2 (specimen from Wyoming Co.) and *Idem,* 1918, Barbour, Upshur and west. por. Randolph Cos. Rept., p. 792, pl. xliv, figs. 1, 1a (specimen from Upshur Co).

sociated with subelliptical specimens of the type of *L. carbonaria*. The latter, as represented by *L. mytiloides?* of Meek, apparently varies from a subquadrate to a more regularly elliptical form. The subquadrate variety approaches *L. kanawhensis*, as represented by the original figures of the species[39], but appears to be more elliptical in outline, less truncate anteriorly and more tapering posteriorly.

Shells considerably smaller than the type specimens have been referred to *L. kanawhensis*. Other specimens which appear to form a series connecting this species with *L. carbonaria* have been found associated with shells referred to these species.

The specific name *lemniscata* was applied by the writer to minute lingulas of variable shape among which a tendency to a pear-shaped form may be discerned. The most markedly pear-shaped of the type specimens, which has an outline resembling that of a lemniscate curve, was selected for illustration. A broadly subelliptical form with anterior and posterior ends regularly and broadly rounded is the most abundant shape represented among the shells referred to this species. Although presenting a variety of shapes, these specimens are all minute and were found in close association at the two localities where they have been found, and they have been retained in a single species. Varieties resembling in outline *L. carbonaria, L. kanawhensis* and the variety represented by the illustrated specimen of *L. lemniscata* may be recognized in these tiny specimens.

Thus, a number of shapes in various sizes may be distinguished among the specimens of *Lingula* obtained by the writer in West Virginia. They may be enumerated as follows:

1. *L. carbonaria* (*L. mytiloides*? of Meek and Worthen); in medium to small sizes.
2. Gradations between "1" and *L. kanawhensis;* in medium to small sizes (referred to *L. kanawhensis*).
3. Gradations between "1" and *L. lemniscata*; in minute sizes (referred to *L. lemniscata*).
4. *L. kanawhensis* as represented by the original illustrations; in large to small sizes.

[39]West Virginia Geol. Surv., 1914, Kanawha County Rept., pl. i (of pt. iv), figs. 5 and 6.

5. A variety somewhat closely resembling *L. umbonata*; in medium sizes (referred to *L. kanawhensis*).
6. Gradations between "5" and *L. lemniscata*; in minute sizes (referred to *L. lemniscata*).
7. *L. lemniscata* as represented by the original illustration; in minute sizes.
8. Subcircular to broadly subelliptical forms; in minute sizes (referred to *L. lemniscata*).

For the present the above forms will be retained under the three specific names, *L. carbonaria, L. kanawhensis* and *L. lemniscata* as indicated above. The recognition of *L. umbonata* Cox in West Virginia collections depends upon the variations in size and proportions of Cox's specimens, which the writer has not seen. It seems likely that the shells noted above in section "5" may be true *L. umbonata.*

Lingula carbonaria Shumard.

Lingula carbonaria. Shumard, 1858, Acad. Sci. St. Louis, Trans., vol. i, p. 215.
Coal Measures: Clark County, Missouri.

Lingula mytiloides? Meek and Worthen, 1873, Illinois Geol. Surv., vol. v, p. 572, pl. xxv, figs. 2a, 2b, 2c.
Coal Measures: Illinois.

Description.—Subelliptical to elliptically subquadrate forms; slightly smaller than Figs. 2a and 2c of Meek's *L. mytiloides?* and resembling more nearly the latter figure in outline.

This is the form which was figured in a report on the fossils of Kanawha County[40] as *L. umbonata* Cox, which was regarded as an immature form of *L. carbonaria.* It seems best[41], however, not to use Cox's name for this species as he figured a small form of subpentagonal shape which may represent a distinct species. Larger shells resembling in shape Cox's illustration have been found in West Virginia. The relationships of these species have been more fully discussed above under the remarks on the genus *Lingula.*

[40]West Virginia Geol. Surv., 1914, Kanawha County Rept., pl. 1 (of pt. iv), fig. 3.

[41]Following Girty, U. S. Geol. Surv., 1915, Bull. 544, p. 49.

Dimensions of two specimens:

Length, mm.	Width, mm.
7.5	4.75
7.5	4.75

Occurrence.—Kanawha Group, Kanawha Black Flint Horizon, on the line between Webster and Nicholas Counties, Locality 152 (a); Webster County, Locality 188 (?), an immature specimen.

Lingula kanawhensis Price.

Lingula kanawhensis. Price, 1914, West Virginia Geol. Surv., Kanawha County Rept., p. 647 (p. 9 of reprint), pl. i (of pt. iv), figs. 5, 6.

Description.—Small shells about the size of *L. carbonaria* Shumard and differing only slightly from it[42]. The anterior margin is slightly subtruncate and the shell is more nearly subquadrate than published figures of *L. carbonaria.* I am, however, by no means certain that most of the medium-sized and smaller shells from West Virginia which have been referred by me to *L. kanawhensis* had not better be regarded merely as extremely subquadrate varieties of *L. carbonaria.* The relationships of the two species have been discussed above under the remarks on the genus *Lingula.*

Dimensions of two specimens:

Length, mm.	Width, mm.
9.5	5.5
6.5	4.0

Occurrence.—Kanawha Group (?), Eagle Shale (?), Preston County, Locality 207 (a). New River Group, Hartridge Black Shale, Preston County, Locality 208 (a).

Lingula lemniscata Price.

Plate xxxiv, figs. 6-8.

Lingula lemniscata. Price, 1916, West Virginia Geol. Surv., Raleigh and west. por. Summers and Mercer Cos., Rept., p. 691, pl. xxx, fig. 3.
Kanawha Group: Eagle Limestone, Raleigh County, West Virginia.

Description.—Minute examples of this tiny species; more elongated than the figured specimen from Raleigh County but

[42]Most nearly like fig. 2a of *L. mytiloides?* Meek and Worthen Illinois Geol. Surv., 1873, vol. v, pl. xxv.

similar to other individuals of the species at the type locality. Measurements of four specimens, including the largest of this collection:

Length, mm.	Width, mm.
3.30	2.10
2.60	2.00
2.20	1.40
2.00	1.35

This tiny species appears to be quite variable in shape; pear-shaped, subcircular, broadly subelliptical and slightly elongate forms are associated at the localities where the species has been obtained. The specimens from Mingo County are chiefly of subelliptical shapes with one example of "lemniscate" form. The various shapes are connected by intermediate forms and the specimens are found in close association with each other. Among the specimens so far obtained broadly subelliptical forms predominate, many having a slight tendency toward the pear-shaped variety.

Figure 6 shows the most nearly pear-shaped specimen obtained from the Mingo County collection; the postero-lateral margins diverge from the umbo at an angle of about sixty degrees.

Occurrence.—Kanawha Group, upper portion, HORIZON NOT DETERMINED, Mingo County, Locality 177 (aa).

Genus DERBYA Waagen.

Two species of *Derbya* have been cited by the writer in previous reports of West Virginia fossils, *D. crassa* (Meek and Hayden) and *D. robusta* (Hall). Where specimens have been referred to the larger *D. robusta* there have also been present, usually in greater abundance, small shells which have been listed as *D. crassa*. Specimens intermediate in size have been referred to one or the other species in a somewhat arbitrary manner.

D. crassa has come to be regarded as possessing the characters described by Grabau and Shimer[43] as follows:

"Subquadrate, owing to the broadly rounded front and somewhat straightened lateral margins. Pedicle valve nearly flat and usually with a somewhat distorted beak. Brachial valve gently convex in the middle. Surface marked by numerous raised radiating striae crossed by concentric lines and stronger growth lamellae. Average size about 1 inch in length and breadth."

[43]Grabau, A. W., and Shimer, H. W., North American Index Fossils, Invertebrates, 1909, Vol. I, p. 231.

D. robusta has only seldom been illustrated and described; from the preceding species it differs in being larger, in possessing coarser lirae and growth lamellae toward the anterior and lateral portions of the shell and is usually described as having a gibbous brachial valve and a high cardinal area. The coarseness of the sculpture, the gibbosity of the brachial valve and the height of the area are said to increase with age. However, neither species has been rigidly defined as to its limiting dimensions or proportions and several writers[44] have noted that the proportions are variable.

If from published descriptions, dimensions and illustrations, the ratios of convexity relative to width, and of height of area relative to width, be computed, it appears that corresponding ratios for the two species overlap in range to a marked extent. Should an attempt be made to revise the symonymy of the two species on the basis of proportions in these dimensions, we should be confronted with the situation that some of the larger examples of *D. robusta* have proportionally low areas, and some small- or medium-sized individuals, at present referred to *D. crassa,* are considerably more gibbous than others now referred to *robusta.*

In order that some uniformity in the citations of West Virginia derbyas might be attained it has seemed advisable to adopt more or less rigid limits to separate the two species. Since gibbosity often can not be satisfactorily measured on account of crushing and fracturing of the thin shells of medium-sized examples, and since the height of the area and the gibbosity seem not to vary uniformly with size, it appears that size offers the most satisfactory means of defining the limits of the two species.

Derbya crassa in the literature appears to have an average shell-width of 1 inch and seldom to exceed 1.4 inches in this dimension. An exception is a specimen, having a width of 1.7 inches and a high area, described by Hall and Clarke[45]. This shell is described as an old individual and the area is shown to be higher, proportionally, than that of much larger shells referred to *D. robusta* by the same authors and by other

[44]Meek, White, C. A., Keyes and Mather.
[45]Pal. of New York, 1892, vol. viii, pt. i, pl. 11-A, fig. 32.

writers. Other exceptions include only the two specimens referred to *Orthis umbraculum?* by Hall[46] and by Owen[47] which measure, respectively, 2.2 inches and 2.8 inches in width. *D. robusta* seems to range in width, as described and illustrated, from about 1.7 inches to 3 inches or more.

It is here proposed to limit *D. crassa* to shells having a width not greater than 1.5 inches, except such as may be only slightly larger than this and which show also evidences of age and should be regarded, therefore, as examples of this species.

As thus defined, *D. crassa* will include both small shells of moderate convexity and those in which the two valves are of nearly equal planeness. An observation of doubtful value may be mentioned in this connection, which, if found to be generally applicable, may justify this bringing together of forms which might be differentiated. It is that in the dark, carbonaceous, marine shales only smaller sizes of *D. crassa* are commonly found (in West Virginia seldom exceeding 0.7 inch in width) and that these are due apparently to unfavorable habitat, being less ventricose than specimens of the same species from a locality where the waters were clearer. It is almost solely in light-colored and sandy sediments that the more convex shells falling within the limits of *D. crassa*, as here proposed, are found in West Virginia[48].

The following corrections and additions to previous lists of West Virginia derbyas are to be noted:

Abundant shells collected from the Winifrede Limestone in Braxton County at Locality 139 and formerly referred to *D. robusta* become *D. crassa*. These range from small sizes to those having a width of 1.4 inches, including brachial valves with a ratio of convexity to width as high as 1 to 4.7.

Shells from the horizon of the Kanawha Black Flint in Upshur County at Locality 172 formerly reported as *D. robusta* are now removed, with the exception of a single individual, to *D. crassa*.

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[46]Stansbury's Expd. Great Salt Lake, 1852, p. 412, pl. 3, fig. 6.

[47]Geol. Rept. Wisconsin, Iowa and Minnesota, 1852, pl. 5, fig. 11.

[48]See "Maximum size of West Virginia Derbyas as Influenced by Sedimentation," discussed in this report.

Derbya crassa (Meek and Hayden).

Orthisina crassa. Meek and Hayden, 1858, Acad. Nat. Sci., Philadelphia, Proc., p. 261.
Coal Measures: Leavenworth, Kansas.

Description.—Abundant examples of this well-known species were found at one locality. Only the casts of the valves are preserved. These range in size from minute individuals to those of more than average size for the species.

Dimensions.—The width of the valves averages about 1 inch, but a few specimens are broader, the largest measuring 1.35 inches in this dimension. The length of the valves is less than their width, being commonly only 0.8 inch, but reaching a maximum in the collection of 1 inch. The dimensions of 8 pedicle and 6 brachial valves follow:

	Width	Length	Convexity (Approximate)	Height of Area (Approximate)
	Inches	Inches	Inches	Inches
Pedicle valves:	0.350	0.250	.....	.....
	0.475	0.250	0.060	0.060
	0.650	0.450	.....	.....
	0.750	0.600	.....	.....
	0.800	0.450	0.050	.....
	0.950	0.700	0.150	.....
	1.250	0.800	.....	0.125
	1.400	0.950	.....	.....
Brachial valves:	0.475	0.350	0.100	.....
	0.625	0.475	0.100	.....
	0.700	0.450	.....	.....
	0.950	0.750	0.150	.....
	1.000	0.7+	0.300	.....
	1.200	0.900	0.200	.....

The relation of this species to *D. robusta*, which it very nearly resembles, has been considered at some length on a preceding page.

It has been noted by Miss Mark[49] that the individuals found in the Conemaugh Formation in Ohio do not attain as large a size as those in the lower formations of the Pennsylvanian System of that State. There seems to be a similar relationship between individuals of the species found in the

[49]Mark, C. G., Geol. Survey Ohio, 1913, 4th. ser., Bull. 17, p. 300.

Conemaugh Series and in the Kanawha Group in West Virginia, with the exception that large individuals have been found in the Conemaugh in fossiliferous sandstone lentils, wherever these have appeared in the dark shales and limestones which form the usual matrix for the marine shells of this Series. In the Kanawha Group the sediments in which derbyas have been found are predominantly light-colored and sandy.

A specimen of this species showing an area of regenerated shell material has been described on a previous page.[50]

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT, Webster County, Locality 203 (aa); WINIFREDE LIMESTONE, Leslie County, Kentucky, Localities "A" and "B."

MOLLUSCA

PELECYPODA.

Genus CHAENOMYA Meek

Chaenomya sp.

Description.—A distorted cast of the interior of the two valves of a shell with the cast of a portion of the exterior of the right valve, seems quite clearly to belong to the genus *Chaenomya.*

The dimensions of the shell can not be satisfactorily made out from the cast and the specific characters are therefore too uncertain to admit even a plausible guess as to its specific relationships.

The casts represent a shell which had, as nearly as may be determined, the following characters: Transverse, subquadrate shape; anterior beaks; subparallel ventral and dorsal margins; narrowly rounded anterior extremity, with truncated and widely gaping posterior dorsal margins; elongate oval outline of the gaping shell margins; carinate posterior umbonal slope; well-marked excavations behind and in front of the beaks; a prominent, raised ridge anterior to the beaks in the middle of the excavation and an elongated escutcheon

[50]Page 555, fig. 24, and plate xxxiv, fig. 9.

posterior to the beaks which apparently continues to the posterior truncation where the shell is widely gaping; surface markings consisting of sharply marked, concentric ridges which give the shell almost the appearance of being made of lamellae overlapping like the shingles of a house roof, and, crossing these at obtuse angles, parallel, radiating rows of tiny pustules which are very closely and quite regularly spaced, the lines of pustules curving downward and being convex toward the postero-dorsal region.

As represented on the molds, the beaks are placed about one-seventh of the length from the anterior end. However, the molds do not appear to exhibit the entire length of either the anterior or the posterior ends of the shell. The ratio of length to height seems to have been about 2⅓ to 1.

Length of the molds: 40 millimeters; height before crushing, probably between 15 and 20 mm.; thickness, not less than 6 mm.

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT, Webster County, Locality 203.

Genus NAIADITES Dawson.

Naiadites elongata Dawson.

Naiadites elongata. Dawson, 1854, Quart. Jour. Geol. Soc., London, vol. x, p. 39, pl. 23.
Coal Measures: South Joggins, Nova Scotia.

Naiadites (Anthracomya) elongata. Dawson, 1868, Acadian Geol., second ed., p. 204, text fig. 42.
Middle Coal Measures: South Joggins, Nova Scotia.

Description.—This little species is well represented in the collection here described. In addition to its variable outline the configuration of the surface of the valves varies and in some shells there is an abrupt downfolding of the shell between the hinge-line and the posterior umbonal slope which is rather prominently carinated. This feature may have been more common than it appears to have been because the flattening which most of the shells have undergone has obscured the original surface sculpture. In some flattened shells traces of such a carina are visible.

It is not unlikely that the shells from Mingo County, described herewith as immature or undersized examples of *N. carbonaria* Dawson? should be placed in the synonymy of *elongata*. Certain undersized specimens from Webster County referred to the latter species resemble the former in having a relatively long hinge-line. A large fragmentary specimen (Loc. 200) resembles *Myalina subquadrata* in some features but the shell is much distorted and it is thought that this is responsible for the resemblance.

Occurrence.—Kanawha Group, Kanawha Black Flint, Webster County, Localities 193 (c) and 194; Eagle Shale, Localities 189 (c), 190 (?) and 204 (c); Eagle Shale (?), Preston County, Locality 207. New River Group, Skelt Shale, Webster County, Locality 200 (c); Hartridge Black Shale, Localities 192 (a), 195 (a) and 202.

Naiadites carbonaria Dawson?

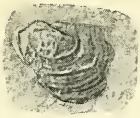
Plate xxxv, figs. 1-2.

Naiadites carbonaria. Dawson, 1854, Quart. Jour. Geol. Soc., London, vol. x, p. 39, pl. 22.
Coal Measures: South Joggins, Nova Scotia.

Naiadites (Anthracoptera) carbonaria. Dawson, 1868. Acadian Geology, second ed., p. 204, text fig. 42; and text fig. p. 182.
Coal Measures: South Joggins, Nova Scotia.

Description.—A large number of small shell impressions from this collection, mostly imperfectly preserved, which appear to belong to the genus *Naiadites*, present certain differences from the form which has commonly been referred by me to *N. elongata*, to which species I was at first inclined to refer them. The specimens present a range in size from tiny forms measuring less than two millimeters in length of hinge to forms five times as long in this dimension. Whether they represent immature forms of *N. elongata* or *N. carbonaria* I am not positive. The latter is described by Dawson as the larger of the two. The specimens of this collection are smaller than the mature sizes of either species. They are here doubtfully referred to *N. carbonaria* which they more nearly resemble, having a greater length of hinge in proportion to length of valves and a straighter hinge-line (than *N. elongata*). The

1



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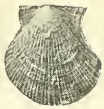

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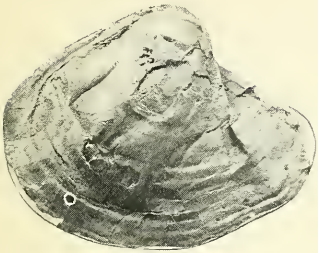

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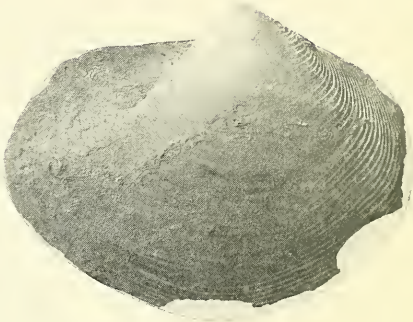

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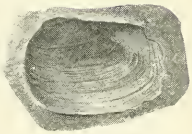

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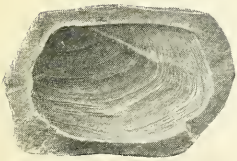

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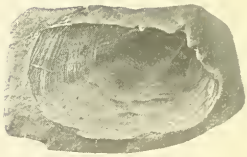

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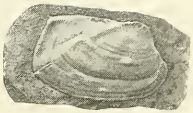

11

M. K. SUMNER, DEL.

POTTSVILLE FOSSILS.

anterior lateral margin shows, in the smaller sizes, a distinct sinuation of the growth lines which indicates the presence of a marginal sinus, rendering the anterior end of the hinge-line somewhat alate. As no specimens have come to hand which are unbroken in this portion of the shell the marginal configuration as described is merely inferential.

Although the margins are not complete in any shell it is clear that the hinge-line is very nearly as broad as the greatest transverse diameter of the shell.

Occurrence.—Kanawha Group, upper portion, HORIZON NOT DETERMINED, Mingo County, Locality 177 (aa).

Genus SCHIZODUS King.

Schizodus affinis Herrick.

Plate xxxv; fig. 6.

Schizodus affinis. Herrick, 1887, Denison Univ., Bull. Sci. Lab., vol. ii, p. 41, pl. iv, figs. 22, 22a.
Coal Measures: Flint Ridge, Ohio.

Description.—A large, flattened specimen obtained at Locality 152 appears to belong to this species. The molds of the interior and exterior of a right valve, the former being the more complete, show the fine concentric lines of the surface of the shell which are as plainly marked upon the internal as upon the external mold. In outline the shell appears posteriorly slightly more produced than the specimen described by Herrick. The beak is apparently situated about two-fifths of the length from the anterior margin, while Herrick describes the beaks of his shell as "distant one-third the greatest length from the anterior margin." Since our shell has been flattened and since the anterior margin is not entire the apparent position of the beak relative to the margins may not be the true one. The variability in outline of species of this genus makes it seem advisable to refer the specimen to this species since the difference noted is slight. A fragmentary specimen from Locality 203 is doubtfully referred to *S. affinis.*

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT, on the line between Webster and Nicholas Counties, Locality 152; Webster County, Locality 203 (?).

Schizodus cuneatus Meek.

Plate xxxv; fig. 5.

Schizodus cuneatus. Meek, 1875, Geol. Surv. Ohio, vol. ii, p. 336, pl. xx, fig. 7.
Lower Coal Measures: Putnam Hill and Flint Ridge, Ohio.

Description.—An imperfect cast of the interior of a left valve seems to be closely related to this species. Although the posterior margin is slightly broken where it joins the hinge-line, a portion of which also is missing, the configuration of the shell can be made out with considerable certainty. Our shell appears to differ from Meek's illustration only in the position of the junction between the subcarinate posterior umbonal slope and the posterior margin. This junction is, in our shell, not "basal," as described by Meek, but rather nearer the mid-height. The truncation of the posterior margin is, accordingly, entirely above the mid-height. It is neither so long nor so inclined as in Meek's illustration, and appears to have been more nearly vertical. Shells of this genus seem to be characteristically variable within specific limits and this variation is not taken to be great enough to warrant the erection of a new species.

Our specimen somewhat resembles *S? spellmani* Herrick[51] which is one of five specimens of *Schizodus* identified by Herrick from this locality. Herrick did not recognize in his collections specimens of *S. cuneatus* Meek which was described from specimens obtained at the same locality and also from Putnam Hill, Ohio. It would seem from Herrick's figure of his left valve on which *S. spellmani* is based, that it differs so slightly from *S. cuneatus*, as figured by Meek from a right valve, that there is little advantage in referring them to separate species. I would, therefore, prefer to regard *S. spellmani* Herrick as a synonym for *S. cuneatus* Meek.

Occurrence.—Kanawha Group, Kanawha Black Flint, Webster County, Locality 203.

[51]Herrick, C. L., Denison Univ., Bull. Sci. Lab., 1887, vol. ii, p. 42, pl. iii, fig. 14. Coal Measures: Flint Ridge, Ohio.

Genus AVICULIPECTEN M'Coy.

Aviculipecten pellucidus Meek and Worthen.

Plate xxxv; Fig. 4.

Aviculipecten pellucidus. Meek and Worthen, 1860, Acad. Nat. Sci. Phil., Proc., p. 455.
Coal Measures: Adams County, Illinois.

Description.—The impressions of the interior and exterior surfaces of a left valve of this dainty little species were found in Mingo County. The sculpture and outlines are almost perfectly preserved except for a small area at the point of the beak. The shell was very small, having a height of 4 millimeters, a length of 4.5 millimeters and a hinge-length of 3 millimeters. The surface sculpture is somewhat finer than that described by Meek, this specimen having 17 lirae in a length of 0.1 inch along the ventral margin. Meek's shell was larger than our specimen and had fewer lirae in an equal marginal length. The fineness of sculpture, however, seems to be somewhat variable in those specimens which have been collected in West Virginia by the writer, although in all cases the sculpture is finer than that described by Meek as seen upon his Illinois shells.

From *Deltopecten coxanus* this species may be distinguished by its slightly more oblique form, its shorter hinge-line, its smaller ears and its finer lirae. The concentric lines are not so close together nor so numerous as upon shells of that species and they divide the spaces between the lirae into more nearly equidimensional segments.

Occurrence.—Kanawha Group, upper portion, HORIZON UNDETERMINED, Mingo County, Locality 177.

Genus DELTOPECTEN Etheridge.

Deltopecten sp.

Description.—Two small, thin, fragmentary pectenoid shells are too indefinite for specific determination but resemble small species of *Deltopecten.* The two specimens, a right and a left valve, are of about the same size and may belong to the same species. Shell broadly lobate, depressed; height and

length about equal; hinge-line straight, ears small, triangular, equal to about one-fourth the height, each separated from the lateral margins by a scarcely perceptible sinus. Right valve flat, its hinge-line 7 mm. in length, its height and length each about 8 mm. Left valve slightly convex. Surface of right valve ornamented by sixteen narrow, rounded, raised ribs separated by flat areas 3 or 4 times as wide as the ribs. Faint, closely spaced, concentric ridges may be seen crossing the flat spaces between the ribs. On the surface of the left valve appear twenty similar ribs.

Of the pectenoid shells known from the Pottsville of the State this most nearly resembles *D. eaglensis* Price, from which it differs in possessing finer, more numerous and more closely spaced ribs, in having the length and height subequal.

Occurrence.—Kanawha Group, WINIFREDE LIMESTONE, Braxton County, Locality 139.

Genus PLEUROPHORUS King.

Pleurophorus sp.

Description.—Several fragmentary casts of small shells, showing the long, narrow, cardinal tooth and two or more faint, radiating, ridges upon the posterior umbonal region with concentric undulations of growth, are referred to the genus *Pleurophorus*. Their specific relationships can not be determined. They suggest, however, *P. occidentalis*.

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT, Webster County, Locality 203.

Genus PLEUROPHORELLA Girty.

Pleurophorella sesquiplicata Price.

Plate xxxv; figs. 7-12.

Pleurophorella sesquiplicata. Price, 1919, West Virginia Geol. Surv., Fayette County Rept., p. 290.
Kanawha Group: Mingo County, West Virginia.

Description.—Shell small, transversely elongate, subrectangular, moderately convex, gibbosity greatest in the anterior and umbonal regions and also along the posterior um-

bonal slope; cardinal margins straight or very slightly convex; shell abruptly down-folded near the cardinal margin, forming a ridge parallel to the hinge-line and enclosing a narrow, well-defined, concave escutcheon; posterior umbonal slope carinated, the ridge or carina extending from the beak to the posterior margin at a point situated about one-third the height from the ventral margin; posterior margin obliquely truncated from this point to the cardinal margin, sloping slightly forward and meeting the cardinal margin in an obtuse angle; posterior margin rounding below into the ventral margin which is broadly arcuate and subparallel to the cardinal margin; between the ridge radiating from the beak along the posterior umbonal slope and that near the cardinal border the shell is flattened and crossed by a faint, radiating ridge (?); anterior margin rounding upward to about the mid-height, thence sloping abruptly backward and upward to the beak; anterior to the beaks the lunule is strongly concave, extending backward under them; beak situated about one-sixth the transverse diameter of the shell from the anterior end; ratio of the height to the transverse diameter, approximately two or three, — whence the specific name. Shell thin; surface marked with extremely fine, closely placed, concentric striae and with coarse undulations of growth; upon the postumbonal region the sculpture is somewhat less marked and in some shells the growth lines are here largely obsolete; covering the surface of the shell are very minute papillae, arranged more or less definitely in concentric and radiating lines; the granules seem to be larger and more prominent posteriorly.

Interior of the shell marked with the concentric undulations of growth which are weak or absent upon the postumbonal region where may be seen grooves corresponding to the radiating ridges of the interior. Muscle markings and pallial line not seen.

Dimensions of four specimens, in millimeters:

Transverse diameter	7.0	8.0	10.0	12.5
Height	4.5	5.0	6.3	8.0
Half-thickness	.....	.....	.....	2.0

The specimens in hand are casts in a shale matrix of the exterior and interior surfaces of disassociated valves. The

beaks are in nearly all cases flattened, obscuring the lunule and escutcheon and making measurements of the thickness untrustworthy.

The presence or absence of a plication on the flattened area between the postumbonal ridge and the ridge bordering the escutcheon is not clear to me. On about one-half of the shells examined such a fold is well defined, in some cases producing at its end a slight convexity in the posterior margin. In all cases, however, this fold is accompanied by a fracture extending a part or the whole of the length of the fold. On unfractured shells no ridge is apparent. Whether the presence of this fold parallel to the postumbonal ridge determined the location of the fracture or whether the fracture produced a false fold I am not able to decide. At least one-half of the specimens possess no such fold. The reference of the species to *Pleurophorella* is therefore somewhat doubtful.

That muscle markings were not observed upon the casts may be due to their crushed condition; however, I am inclined to believe that they were not prominently developed. The pallial sinus could not be distinguished from the growth lines.

The subrectangular shape, straight hinge-line, subparallel cardinal and ventral margins, fine sculpture and ratio of height to transverse diameter, when taken together, serve to distinguish this from other species referred to this genus, all of which are either posteriorly tapering or have coarser concentric sculpture. An exception to the latter statement is perhaps to be found in *P. papillosa,* the type of the genus, which seems to differ from this species only in its large size and in having a width which is twice its height.

In the report from which the above description is quoted it was stated by error that the postumbonal ridge met the posterior margin of the shell "at a point situated about two-thirds the height from the ventral margin." The correct fraction of the height is, as here stated, one-third.

It is chiefly in right valves that the growth lines become almost obsolete in the postumbonal region. Upon the area between the postumbonal ridge and the ridge bordering the escutcheon, in addition to the problematical folds which have

been involved in fracturing, a number of the specimens show one or more very faint, radiating lines and there is a distinct linear arrangement of the minute pustules in lines parallel to the radiating ridges.

Occurrence.—Kanawha Group, upper portion, HORIZON NOT DETERMINED, Mingo County, Locality 177 (aa).

Genus CYPRICARDINIA Hall.

Cypricardinia? carbonaria Meek?

Cypricardinia? carbonaria. Meek, Acad. Nat. Sci., Philadelphia Proc. 1871, vol. xxiii, p. 163.
Lower Coal Measures: Newark, Ohio.

Description.—Three fragmentary shell molds have the form and dimensions of this species but are from one-half to one-third as large as the specimens described by Meek. The hinge-line is not shown and the character of the dentition can not be determined. Two specimens show the impression of the interior of the shell. A larger cast exhibits the impression of the exterior of the shell. Although fragmentary, the latter seems to be the same form as the smaller specimens. It shows, between the "regular, well-defined, subimbricating" ridges, other fine, less regular, concentric lines. The specific determination is not made with certainty.

Occurrence.—Kanawha Group, WINIFREDE LIMESTONE, Braxton County, Locality 139.

GASTROPODA.

Genus SPHAERODOMA Keyes.

Sphaerodoma fusiformis (Hall)

Machrocheilus fusiformis. Hall, 1858, Geol. Surv. Iowa, vol. i, pt. ii, p. 718, pl. xxix, fig. 7.

Description.—A cast of the interior of the shell with the shell substance completely leached away in spite of having been somewhat flattened by pressure in a direction transverse to the axis of the shell rather clearly exhibits the proportions of this species.

There are preserved the casts of the body whorl and of five volutions of the spire and, impressed in the matrix, the mold of at least three more volutions above these, making a total of nine volutions.

Dimensions:—Height of spire above body volution, 0.7 inch; body volution, about 0.65 inch; width of body volution, 0.65 inch, which dimension has been increased by distortion by at least as much as 0.15 inch.

From these dimensions it appears that the shell was somewhat smaller than the specimens from Indiana described by White. It appears that the characteristic fold was present upon the columella.

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT, Webster County, Locality 203.

Gastropoda indeterminata 1.

Description.—Several fragmentary molds of the coils of small gastropods were found in a highly fossiliferous, argillaceous sandstone. The coils, in one of which are preserved portions of two volutions, have about the size and proportions of the small pleurotomaroid species, *Pleurotomaria carbonaria* and *Phanerotrema grayvillense,* which are known in the Pottsville faunas of the State.

Diameter of the largest coil, 5.5 mm.; height of two volutions of the same, 0.3 mm.; thickness of the tube, 1 to 2 mm.

Occurrence.—Kanawha Group, KANAWHA BLACK FLINT HORIZON, Webster County, Locality 203 (c).

Gastropoda indeterminata 2.

Description.—Several flattened, straited, depressed-convex, oval masses showing traces of a spiral structure were found in fine-grained dark shale from which marine fossils (*Orbiculoidea* and *Naiadites*) were obtained. Similar bodies have been interpreted[52] as clay fillings of gastropod shells flattened by the pressure of the superincumbent strata before the

[52]West Virginia Geol. Surv., 1916, Raleigh and west. por. Summers and Mercer Cos. Rept., p. 730.

deposits had become sufficiently lithified to be brittle. In this case the shell of the supposed gastropod must have been leached out before the flattening took place. In the specimens under consideration an extremely thin crust of a white, crystalline material covers the flattened whorl, having apparently been deposited in the cavity formed by the leaching of the shell but is much thinner than the shells of the known species of coiled gastropods of the region.

It would be unsafe to ascribe all similar bodies found in association with the marine faunas to a gastropod origin when no traces of the surface sculpture have been preserved. Their close similarity to bodies which preserve the sculpture in part has led to the reference of these specimens to such an origin.

The largest flattened coil has a long diameter of 0.75 inch and a width of 0.5 inch, with a convexity as great as 0.15 inch (probably as thick as 0.25 inch).

Occurrence.—New River Group, Skelt Shale, Webster County, Locality 200 (c).

CEPHALOPODA.

Genus ORTHOCERAS Breynius.

Orthoceras sp.

Description.—From a single locality have come fragments of casts of cones of *Orthoceras* or allied cephalopoda. I am not sure how many species may be represented by the material. None are good enough to permit a determination of their proportions. The largest fragment measures 1.2 by 2.3 millimeters and the surface of the shell was covered quite closely by small pits of irregular shapes.

Occurrence.—Kanawha Group, Kanawha Black Flint, Webster County, Locality 203.

Genus PSEUDORTHOCERAS Girty.

Pseudorthoceras knoxense (McChesney),

Orthoceras knoxensis. McChesney, 1860, Descr. New Pal. Foss., p. 69. Coal Measures: Danville, Springfield, Peoria, and Dr. E. Hall's mill, Knox County, Missouri.

Description.—A mold of the interior of a portion of a cone, with casts of the interiors of numerous chambers, shows clearly the characters of Doctor Girty's genus, *Pseudorthoceras.* Wedge-shaped spaces between the chamber molds show the configuration of the septa and the characteristic marginal deposits within the chambers.

A length of 58 millimeters of the cone is preserved and casts of twenty-three chambers. The diameter of the cone fragment in its central portion is 3.5 mm. From two to three chambers are included in a length equal to the diameter, placing the shell within the specific limits of *P. knoxense.*

Occurrence.—Kanawha Group, Kanawha Black Flint, Webster County, Locality 203.

ARTHROPODA.

Crustacea? indeterminata.

Description.—The impression of what appears to have been two contiguous somites of the test of a small crustacean was the only fossil collected at one locality. The somites, if such they be, are broadly convex, measuring about 4 millimeters each in width and 7 millimeters in breadth. Each somite is bordered on one edge, which is broadly sinuous in outline, by a narrow ridge. A thin, dark-brown substance covers a part of the cast and may be a portion of the test.

Occurrence.—Kanawha Group, Campbell Creek Limestone, Braxton County, Locality 196.

DESCRIPTION OF PLATES.

PLATE XXXIV.

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Figs. 1-4. *Serpulites sagittifer* sp. nov..... 586

1 and 2. Views of the anterior and posterior ends, respectively, of the shorter fragment of the broken test shown in Fig. 3. Fig. 1 shows both marginal rod-like areas occupied by materials different in composition from the test and matrix. In Fig. 2 only one "rod" is seen, which is the continuation of the rod of galena whose end is shown in Fig. 1. The other rod does not appear in the posterior view, its former presence being indicated by the flattening of the median portion of the tube.

t, black, chitinous test;
m, dark, fine-grained material similar to the matrix of the tube;
bf, light-brown, fine-grained material filling a length of at least 2 mm. of one cylindrical area;
g, crystalline sulphide resembling galena and filling a length of 4 mm. of the other cylindrical area;
wc, minute, white, vitreous crystals encrusting a cube of galena at this point and filling a portion of the same cylindrical area in the longer fragment of the tube shown in Fig. 3.
p, minute grain of a brassy sulphide resembling pyrite.....x 11.

The small oval beneath Fig. 1 shows natural size of cross-section of tube.

3. View of a portion of a tube not completely flattened. Two fragments of the tube remain, connected by portions of the test embedded in the matrix, a ferruginous nodule. Course of one marginal area may be followed through cavity in larger fragment, where test is broken away, to white spot at end of fragment, where white vitreous crystals fill the area, to rod of galena shown in Figs. 1 and 2 and seen in this figure as a gray irregularly oval spot where a small piece of test has broken off.....x 3⅓

Kanawha Black Flint horizon, Lewis County, Locality 106. COTYPE.

4. A tube flattened into a ribbon, only small portions of the test remaining; marginal cylindrical areas appearing as concave grooves which in places pass into convex rounded ridges; this arrangement suggests that the marginal areas were tube-like, portions being filled with rigid matter which made concave impressions in the matrix while other portions were empty, allowing the test to be crumpled in and leaving convex molds of the collapsed portions.

Winifrede Limestone horizon, Braxton County, Locality 139. COTYPE .....x 1

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Fig. 5. *Gnatholites productus* sp. nov.....x 18, 589

Paired jaws with the impressions in the matrix of missing portions. The base of the jaw proper of the more complete jaw has not been correctly delineated; the gash-like furrow cutting diagonally across the base of the jaw continues across the ribbon-like, posterior process to the point of approximation of the jaws, becoming narrower and shallower there; the cutting edge of this jaw posterior to the small "tooth" presents a less concave outline than that shown in the figure and has a small convexity about midway of its length.

Winifrede Limestone horizon, Braxton County, Locality 139. HOLOTYPE.

Figs. 6-8. *Lingula lemniscata* Price.....x 4, 595

Three minute shells of varying proportions.

Kanawha Group, upper portion, horizon not determined, Mingo County, Locality 177.

Fig. 9. *Derbya crassa* (Meek and Hayden).....x 2, 599

The mold of the interior of a pedicle valve showing the impressions of the striated cardinal area, of the deltidium, of the median septum and of the grooves of the interior surface, representing the lirae of the exterior; upon the cast is seen an irregular, tongue-shaped area of abnormal surface sculpture which is interpreted as a portion of shell regenerated after the breaking away of the original shell substance.

Kanawha Black Flint horizon, Webster County, Locality 203.

PLATE XXXV.

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Figs. 1 and 2. *Naiadites carbonaria* Dawson?..... 602

Right and left valves, respectively; casts of the interior of the valves of immature or stunted individuals. Although the margins are not complete the approximate configuration of the valves may be inferred from the courses of the concentric growth lines.

1. Right valve.....x 2
2. Left valve.....x 2⅔

Kanawha Group, uppper portion, horizon not determined, Mingo County, Locality 177.

Figs. 3 and 4. *Aviculipecten pellucidus* Meek and Worthen) .....x 3, 605

3. Mold of the interior of a small valve with the surface of the beak abraded.
4. Mold of the exterior of the same.

Kanawha Group, upper portion, horizon not determined, Mingo County, Locality 177.

Fig. 5. *Schizodus cuneatus* Meek.....x 1, 604

The mold of the interior of a left valve, somewhat crushed and with the margins broken. Approximate position of margins indicated. Slightly greater than natural size.

Kanawha Black Flint horizon, Webster County, Locality 203.

Fig. 6. *Schizodus affinis* Herrick.....x 1, 603

The mold of the interior of a large, flattened right valve with beak slightly more centrally located than in Herrick's illustration. Appproximate position of margins indicated.

Kanawha Black Flint horizon, Webster-Nicholas County Line, Locality 152.

Figs. 7-12.—*Pleurophorella sesquiplicata* Price.....x 1, 606

7 and 8. Casts of the interior and exterior, respectively, of the valves lying adjacent to each other in the matrix; the outlines imperfect. Upon the cast of the exterior of the left valve are two very faint radiating lines between the postumbonal and cardinal ridges. The pustules in this portion of the shell have a distinctly linear arrangement parallel to the faint ridges.

9 and 10. Casts of the exterior of two right valves.

11. The cast of the interior of a right valve.
12. The cast of the exterior of a left valve.

Kanawha Group, upper portion, horizon not determined, Mingo County, Locality 177. COTYPES.

INDEX TO PART IV.

APPENDIX.

Levels Above Mean Tide.

RAILROAD LEVELS.

THE BALTIMORE AND OHIO RAILROAD.

West Virginia and Pittsburgh Branch.

Distances from Clarksburg	Stations	County	Elevation
62.2	Flatwoods	Braxton	1142.90
63.9	Hopkins	Braxton	1033.40
64.6	Morrison	Braxton	1091.00
64.8	No. 2 Tunnel	Braxton	894.00
67.6	Gillespie	Braxton	
67.6	G. F. Stockert Lumber Co.	Braxton	
67.6	W. Va. Pulp & Paper Co.	Braxton	
67.6	J. A. Baker, Lumber	Braxton	
69.7	Holly Junction	Braxton	920.20
72.4	Bakers Run	Braxton	939.20
74.4	Centralia	Braxton	953.50
74.4	John Paulhamus & Son	Braxton	
76.5	Custis	Braxton	1071.10
79.7	S. Hinkle & Co.	Webster	
80.5	R. F. Stout Lumber Co.	Webster	
82.9	Erbacon	Webster	1525.40
85.3	Wainville	Webster	1574.90
85.6	Berne	Webster	
86.8	Weese	Webster	1721.30
87.7	Hardwood	Webster	
89.0	Jack	Webster	
90.3	R. F. Stout Lumber Co.	Webster	1920.90
90.6	Halo	Webster	2066.90
91.8	Poplar	Webster	2183.90
92.2	Smoot Lumber Co.	Webster	
92.7	Cookman	Webster	2244.90
93.9	Cowen	Webster	2247.90
94.5	Welch Glade	Webster	2236.00
95.3	Howard (Smoot Lumber Co.)	Webster	2210.00
97.1	McCarty	Webster	2210.00
99.7	Laurel Siding (Wm. Whitman & Son)	Webster	
101.0	Gauley Co. (Lumber Repair Track)	Webster	
101.4	Gauley Company Lumber Siding	Webster	
101.8	Gauley Mills	Webster	
102.3	Huff Smith Mill Siding	Webster	
102.4	Camden-on-Gauley	Webster	2029.30
103.3	Smoot Lumber Co.	Webster	
103.4	Allingdale	Nicholas	2028.90
103.4	W. C. White Lumber Co.	Nicholas	
103.4	Strouds Creek & Muddlety R. R. Junction	Nicholas	

Pickens Branch.

West Virginia and Pittsburgh R. R.

Distances from Macpelah Junction	Stations	County	Elevation
40.8	Newlon	Upshur	1912
43.1	Thos. G. Brady	Upshur	.....
43.2	Craddock	Randolph	2061
43.2	Arvondale Junction	Randolph	2260
46.8	Silica	Randolph	2341
47.0	Mt. State Silica Sand Co.	Randolph	.....
47.5	Henry Spies	Randolph	.....
50.2	Pickens	Randolph	2697
50.2	Holly River Lumber Co.	Randolph	.....

ALEXANDER & EASTERN RAILROAD

Miles	Stations	County	Elevation
0	Junction of W. Va. & P. Br., B. & O.	Upshur	1690
5	Palace Valley	Upshur	1930
6	Camp Creek	Randolph	2000
8	Star	Randolph	2115
10	Beech Run	Randolph	2260
14	Tenneys	Randolph	2400
15	"Y"	Randolph	2500
17	Junction	Randolph	2550
17¼	End of Line	Randolph	2565

U. S. GEOLOGICAL SURVEY* LEVELS

COWEN QUADRANGLE

From Birch River post-office southeast up Birch River to Welch, Glade, thence southwest to Craigsville.

Feet.

Boggs, near post-office, 250 feet east of school, 20 feet north of road, in outcrop of rock; bronze tablet stamped "1555 Knwa" 1,555,797

Welch Glade, about 1 mile northwest of, 725 feet southeast of road from top of mountain to Cowen and Glade Run, about 500 feet southeast of house and 0.25 mile northwest of church on east side of road, in rock; bronze tablet stamped "2253 Knwa" (reported in 1915 as destroyed)..... 2,254.137

Lanes Bottom, (near Camden on Gauley), at "The Camden" in west side, in pier to porch; bronze tablet stamped "2062 Knwa" (reported in 1915 as destroyed)..... 2,062.872

Craigsville, near east end of, 670 feet east of Cranberry road and hotel, north of road in front of Macon Rose's house; bronze tablet stamped "2288 Knwa" (reported in 1915 as destroyed; drill hole remains)..... 2,289.033

From Craigsville along highways up Beaver Creek to Delphi, thence west down Muddlety Creek to Hookersville.

Hookersville, 5 miles east of, 225 feet east of fork of Muddlety, at crossing of Right Hand Fork, north of road west of crossing, in overhanging rock; aluminum tablet stamped "2005 Knwa"..... 2,005.563

From Craigsville southeast along highways via Woodbine and Richwood to Manning Knob.

Woodbine, 4.5 miles southeast of, on west side of Greenbrier Road, south of trail running west, in hollow near maple tree, in rock; bronze tablet stamped "2969 Knwa"..... 2,970.667

From Erbacon south along Baltimore & Ohio R. R. to Fenwick.

Wainville, in east end of south abutment of bridge over Laurel Creek; bronze tablet (not stamped)..... 1,572.543

Wainville, in front of sign-post; top of west rail..... 1,576.7

Wainville, 0.7 mile south of, east side of track, in telephone-pole; spike marked "U. S. B. M. 1632"..... 1,632.07

Weese, in front of sign-post; top of east rail, marked "U. S. 1721"..... 1,721.4

Weese, 0.3 mile south of, northwest corner of road crossing, in sign-post; spike marked "U. S. B. M. 1746"..... 1,746.08

Arcola, in front of sign-post; top of east rail, marked "U. S. B. M. 1856"..... 1,856.6

Arcola, 0.2 mile south of, west side of track, in ledge; bronze tablet stamped "1875"..... 1,875.274

*From Bulletin 632, U. S. Geological Survey, 1916.

Feet

Arcola, 1.3 miles south of, east side of track, in telephone-pole; spike marked "U. S. B. M. 1970"..... 1,970.55
Halo, (Marcus post-office, in front of sign-post; top of west rail, marked "U. S. 2080"..... 2,080.4
Halo, 300 feet south of station, northeast corner of road crossing in ledge; bronze tablet stamped "2085"..... 2,085.554
Halo, 1.5 miles south of, east side of track, in telephone-pole; spike marked "U. S. B. M. 2214"..... 2,215.14
Cowen, in front of station; top of east rail..... 2,244.4
Cowen, in west end of first step to entrance of First Baptist Church; bronze tablet stamped "2253"..... 2,254.144
Cowen, 1 mile south of, northwest corner of road crossing, in sign-post; spike marked "U. S. B. M. 2222"..... 2,223.16
Cowen, 2.1 miles south of, east side of track, in telephone-pole; spike marked "U. S. B. M. 2211"..... 2,212.11
Cowen, 3.2 miles south of, in east end of south abutment of bridge over Big Ditch Run; bronze tablet stamped "2202"..... 2,202.493
Cowen, 4.4 miles south of, east side of track, in telephone-pole; spike marked "U. S. B. M. 2131"..... 2,132.09
Cowen, 5.6 miles south of, east side of track, in telephone-pole; spike marked "U. S. B. M. 2063"..... 2,063.30
Cowen, 6.9 miles south of, west side of track, in ledge; bronze tablet stamped "2039"..... 2,039.671
Gauley Mills, in front of platform; top of east rail, marked "U. S. 2035"..... 2,035.7
Gauley Mills, 0.5 mile northwest of, on east end of north abutment of wagon bridge over Gauley River; chiseled square, marked "U. S. B. M. 2029"..... 2,030.09
Camden on Gauley, east side of water-tank, at foot of ladder, in concrete block; bronze tablet stamped "2025"..... 2,025.748
Camden on Gauley, in front of station; top of east rail..... 2,034.0
Allingdale, in front of station; top of west rail..... 2,022.7
Allingdale, east end of south abutment of bridge "104 A"; chiseled square, marked "U. S. B. M. 2021"..... 2,021.83
Allingdale, 1 mile south of, west side of track, in telephone-pole; spike marked "U. S. B. M. 2022"..... 2,022.36
Allingdale, 2.5 miles south of, east side of track, in ledge; bronze tablet stamped "2018"..... 2,018.595
Allingdale, 3.6 miles south of, 60 feet north of north portal of tunnel, west side of track, in telephone-pole; spike marked "U. S. B. M. 2008"..... 2,008.19
Allingdale, 4.6 miles south of, west side of track, in telephone-pole; spike marked "U. S. B. M. 1978"..... 1,979.08
Cranberry, in front of station; top of west rail..... 1,937.93
Cranberry, in west end of south abutment of bridge over Cranberry River; bronze tablet stamped "1936"..... 1,936.806
Cranberry, 1.1 miles south of, east side of track, on ledge; chiseled square, marked "U. S. B. M. 1919"..... 1,919.36
Curtin, in front of station; top of south rail..... 1,910.0
Curtin, 285 feet east of station, 10 feet west of switch signal, south side of track, in ledge; bronze tablet stamped "1913"..... 1,913.501
Cole's Siding, in front of platform; top of west rail..... 1,940.8
Cole's Siding, 45 feet south of south end of platform, west side of track, in telephone-pole; spike marked "U. S. B. M. 1940"..... 1,940.51

Feet

Cole's Siding, 1.2 miles south of, west side of track, in telephone pole; spike marked "U. S. B. M. 1987"..... 1,987.56

Holcomb, in front of platform; top of west rail..... 2,026.0

Holcomb, in east end of north abutment of bridge over Morris Creek; bronze tablet stamped "2025"..... 2,025.235

From Cowen east along highway 2.3 miles.

Cowen, 1.1 miles east of, 50 feet west of road forks, north side of road, in root of stump; copper nail with washer stamped "U. S. G. S. W. Va. B. M."..... 2,322.54

Cowen, 2.3 miles east of, south side of road, opposite concrete watering-trough, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2271"..... 2,271.64

Cowen, 3.5 miles east of, south side of road, in stump; copper nail with washer stampeed "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2210"..... 2,210.39

Dyer post-office, 2.6 miles west of, 15 feet west of road forks, north side of road, on ledge; chiseled square marked "U. S. B. M. 2194"..... 2,194.99

From Richwood northeast 3.6 miles along log railroad (leveled twice).

Richwood, 2.6 miles north of, east side of track, in boulder; bronze tablet stamped "2350"..... 2,350.491

Richwood, 3.6 miles northeast of, north side of track, in telephone-pole; spike marked "U. S. B. M. 2453"..... 2,454.04

From Craigsville southwest along highway to Summersville (1 foot error in this line).

Beaver, floor of bridge over Beaver Creek..... { 2,110.5 / 2,111.5

Beaver Creek, surface of water June 21, 1899..... { 2,102 / 2,103

Beaver, 2.7 miles southwest of. at the Hicks House, on stone step to stile, marked "2267" on woodwork..... { 2,268.15 / 2,269.15

Beaver, 3.7 miles southwest of, 1 mile west of Hicks House, about 800 feet northeast of Horse Run, 300 feet west of house in hollow, at edge of timber, north side of road, bronze tablet stamped "2140 Knwa" (reported destroyed, 1915) { 2,140.287 / 2,141.287

HACKER VALLEY QUADRANGLE.

From Bablin south along highway to Jumbo, thence west to Diana.

Bablin, 1 mile south of, at junction of Little Kanawha River, and Wildcat Creek, in west side of north end of wire footbridge; copper nail "972.6"..... 972.33

Wildcat post-office; 400 feet east of, in rock north side of road; chiseled square, painted "950.2"..... 949.84

Feet

Bois post-office, at south side of ford at Right Fork of Little Kanawha River, in boulder; bronze tablet stamped "1079"..1,079.147

Bois post-office, 1.6 miles south of, in gap at head of Williams Camp Run, in root of oak, south side of road; copper nail, painted "1611.5"....1,611.31

Bois post-office, 2 miles south of, east margin of road in rick; chiseled square, painted "1513.9"....1,513.65

Wheeler post-office, 1 mile north of, at run crossing, east margin of road, at junction with Back Fork road, in ledge; bronze tablet stamped "1438"....1,437.317

Wheeler post-office, 0.3 mile south of, in rock east margin of road; chiseled square, painted "1474.1"....1,473.83

Pugh, 0.3 mile north of, in boulder west margin of road; bronze tablet stamped "1450"....1,450.200

Hacker Valley, ½ mile southwest of, along road to Pugh, at ford over Back Fork, in east end of foot-bridge; copper nail painted "1476.4"....1,476.14

Hodam, 0.3 mile north of, along road to Hacker Valley, in tree stump in field 10 feet west of road center, 110 feet south of R. F. D. "29;" copper nail, painted "1602.4"....1,602.25

Hodam, 0.2 mile south of, at road fork, in boulder east margin of road; bronze tablet stamped "1658"....1,657.323

Hodam, 0.8 mile south of, along road to Jumbo, in rock east margin of road, chiseled square painted "1853.0"....1,851.87

Hodam, 1.7 miles south of, at road corner, in ledge in triangle of roads, chiseled square painted "2420.7"....2,420.61

Jumbo, 0.9 mile north of, on road to Hodam, in rock west margin of road; chiseled square painted "1949.0"....1,948.84

Jumbo post-office, 400 feet east of, at road corner in boulder north side of foot-bridge over Holly River; bronze tablet stamped "1544"....1,543.698

Jumbo post-office, 1.2 miles west of, along Holly River, 230 feet south of ford, at mouth of Mud Lick Run, in root of tree; copper nail, painted "1436.3"....1,436.07

Diana, 2 miles east of, up Holly River, in large boulder north end of foot-bridge; chiseled square, painted "1356"....1,355.74

From point 2 miles west of Removal southeast along West Virginia Midland R. R. to point 1 mile southeast of Summit.

Removal (Salisbury Station), 2 miles west of, in boulder north side of railroad track; bronze tablet stamped "1049"....1,048.283

Removal (Salisbury Station), 100 feet west of post-office, in ledge south side of West Virginia Midland Railroad track; bronze tablet stamped "1095"....1,095.182

Diana, at ford of Holly River between railroad station and post-office, in boulder south edge of road, west of river; bronze tablet stamped "1241"....1,240.426

Diana, at intersection of old railroad grade and road to Jumbo, in stone west margin of road; chiseled square painted "1264.0"....1,263.80

Diana, 2.6 miles southeast of, at railroad water station, in boulder 75 feet west of track, 50 feet south of tank; bronze tablet stamped "1638"....1,637.761

Summit, 1 mile southeast of, in ledge east margin of track. 500 feet southeast of "incline;" bronze tablet stamped "1857"....1,856.490

Near southeast corner of quadrangle.

	Feet
Bernardstown, 1 mile east of, north margin of road, in shale; chiseled square, painted "1753.6"	1,753.33
Bergoo, 3.1 miles northeast of, at Chestnut Bottom Ford School, on south side of river, at ford, 10 feet south of road in rock; bronze tablet stamped "1906"	1,905.831

From point near Newlon south along Baltimore & Ohio R. R. to point near Silica.

Newlon, 1.5 miles south of, at sixty-seventh mile-post, at north side of third joint north of; top of east rail, painted "2001.8"	2,001.5
Craddock, 0.1 mile north of, in east corner of south abutment of railroad bridge 67 A, bronze tablet stamped "2040"	2,039.911
Arvondale Junction, on railroad bridge 70 A; top of southernmost bolt in east guard-rail, painted "2238.4"	2,238.31
Arvondale Junction, 1 mile south of, 14 rails south of seventy-first mile-post, at north side of joint; top of east rail, painted "2315.3"	2,315.0

From Hacker Valley east along Pickens & Hacker Valley R. R. to Pickens, Baltimore & Ohio R. R. (There is an error of 1 foot to be located in this line).

Hacker Valley, in southeast corner-stone of residence of S. J. Cutlip, bronze tablet stamped "1501"	[1]1,500.848
Siding, 1 mile east of Hacker Valley, 250 feet east of switch, top of south rail on east edge of joint, painted "1616.9"	[1]1,616.7
Hacker Valley, 3.2 miles east of, in rock north margin of track, bronze tablet stamped "1827"	[1]1,826.406
Hacker Valley, 6.5 miles east of, in rock north margin of track, bronze tablet stamped "2429"	[1]2,429.203

PICKENS QUADRANGLE.

From Hacker Valley east along Pickens & Hacker Valley R. R. to Pickens, portion of line. (There is an error of 1 foot to be located in this line. See Hacker Valley Quadrangle for other bench marks.)

Pickens, 3.5 miles west of, 500 feet west of railroad and road crossing in gap, in rock south of margin of track; bronze tablet stamped "2883"	[1]2,883.095

From Selbyville south along Baltimore & Ohio R. R. to point near Newlon.

Newlon, 0.5 mile south of, at sixty-sixth mile post, at north side of third joint south of; top of east rail, painted "1929.6"	1,929.4

[1]Or 1 foot higher.

From Silica southeast along Baltimore and Ohio R. R. to Pickens.

	Feet
Silica, 2,300 feet south of, in west corner of north abutment of railroad bridge 72 A, at seventy-second mile-post; bronze tablet stamped "2385"	2,384.704
Pickens, 2 miles north of, at seventy-third mile-post, at south side of joint opposite; top of east rail, painted "2500"	2,499.7
Pickens, 1 mile north of, at seventy-fourth mile-post, at south side of first joint north of; top of west rail, pointed "2615.7"	2,615.7
Pickens, in top stone in northwest corner of retaining wall at the residence of Mr. Wasmer; bronze tablet stamped "2701"	2,700.919
Pickens, 0.5 mile south of, on road to Florence, in rock west margin of highway; chiseled square, painted "2802.3"	2,802.346

From point near Samp east along highway to Monterville, thence north and west to Pickens.

Samp post-office, 3.5 miles west of, in Big Run, in ledge north side of road; bronze tablet stamped "2022"	2,021.327
Samp post-office, 1.2 miles west of, south edge of road, in rock; raised chiseled square, painted "2178.6"	2,178.23
Samp post-office, 0.5 mile east of, 350 feet below Whitaker Falls, in ledge north side of road; bronze tablet stamped "2164"	2,163.708
Samp post-office, 1.8 miles east of, up Elk River road, in rock south margin of road; raised chiseled square, painted "2271.2"	2,270.82
Store, junction of Valley and Dry Forks, 0.3 mile west of, down Elk River road, in rock north margin of road; chiseled square, painted "2270.2"	2,269.72
Blue Spring, 2.1 miles west of, at fork of road, at junction of Valley and Dry Forks, in rock north edge of road; bronze tablet stamped "2299"	2,298.369
Blue Spring post-office, 1.1 miles west of, in rock north margin of road; chiseled square, painted "2525.5"	2,525.10
Monterville post-office, 0.3 mile west of, down Valley Fork road, ¼ mile west of summit, in rock in north margin of road; bronze tablet stamped "2949"	2,948.457
Monterville post-office, in foundation post at southeast corner of old store, at road corner; copper nail, painted "2998.3"	2,997.94
Monterville post-office, 1.3 miles northwest of, along pike, at road corner to Logan's farm, in bed rock northwest corner; chiseled square, painted "3234.5"	3,234.12
Monterville post-office, 2 miles northwest of, along Pickens road, 0.3 mile north of pike corner, west margin of road, in boulder; bronze tablet stamped "3237"	3,237.067
Monterville post-office, 3.3 miles northwest of, along Pickens road, in rock west margin of road; chiseled square painted "3703.9"	3,703.56
Monterville post-office, 5.8 miles northwest of, along Pickens road, in rock in east margin of road; chiseled square painted "3722.3"	3,722.00

Feet

Monterville post-office, 7 miles north of, along Pickens road, under Whitman Knob in rock east margin of road; bronze tablet stamped "3735"....3,734.868

Pickens, 6.2 miles southeast of, along road to Monterville, in rock south margin of road; chiseled square painted "3655.6"....3,655.23

Pickens, 5.3 miles southeast of, along road to Monterville, in ledge south edge of road, 500 yards southeast of Zehnder's farm; bronze tablet stamped "3775"....3,774.348

Pickens, 4.2 miles southeast of, along Monterville road, at 90° bend in road in front of farm of L. Wuchner north edge of road, in rock; chiseled square, painted "3621.1"..3,620.77

Pickens, 2.5 miles southeast of, along Monterville road, under Turkey Bone triangulation station in rock east edge of road, at root of tree; bronze tablet stamped "3582"....3,581.356

Pickens, 1.1 miles southeast of, along Monterville road, 0.7 mile south of fork, in rock east margin of road; chiseled square, painted "3025.9"....3,025.37

SUTTON SPECIAL (SUTTON 30′) QUADRANGLE.

From Birch River eastward along highway to Erbacon, thence north along Baltimore & Ohio R. R. to Gillespie.

Birch River post-office, 3 miles east of, 150 feet west of Birch Valley Schoolhouse (No. 24), 170 feet east of ford, north of river and road, in east end of large boulder; aluminum tablet stamped "1186"....1,186.291

Waggy post-office, 0.5 mile west of, south of ridge road, 300 feet west of tramroad and water-tank, 0.3 mile east of road forks, in boulder; aluminum tablet stamped "2085"....2,084.728

Waggy post-office, 1 mile east of, north of county road, south of tramroad, near summit, 0.4 mile from where tramroad leaves ridge road, in outcrop of rock; aluminum tablet stamped "2176"....2,176.059

Erbacon, 100 feet east of post-office, 100 feet south of station, in abutment at northwest end of Baltimore & Ohio bridge over mouth of Missouri Creek; aluminum tablet stamped "1518"....1,517.854

Defoe, in front of station; top of rail....1,401

Erbacon, 2.7 miles north of, east of railroad, 0.1 mile north of Defoe Station, 150 feet south of mile-post 81, in top stone culvert; aluminum tablet stamped "1373"....1,373.151

Erbacon, 3.7 miles north of, west of railroad, east of Laurel Creek, 150 feet south of mile-post 80, on outcrop of sand rock; chiseled square marked "1286"....1,285.97

Erbacon, 4.7 miles north of, west of railroad, 200 feet south of mile-post 79, on sand rock; chiseled square marked "1203"....1,203.03

Prestonia post-office, 0.1 mile north of, near mouth of Brooks Creek, in top stone of abutment to railroad bridge over Laurel Creek; aluminum tablet stamped "1137"....1,137.121

Centralia, 400 feet south of post-office, opposite G. E. & H. A. Hyer's store, 40 feet south of road crossing, 400 feet south of station, 20 feet east of railroad, 0.1 mile south of mouth of Laurel Creek, in stone culvert; aluminum tablet stamped "945"....944.819

	Feet
Centralia, 1.1 miles north of, east of railroad, west of Elk River, opposite rock cliff, 200 feet south of mile-post 48, on outcrop of sandrock; chiseled square marked "952"	951.71
Bakers Run, 1 mile north of, west of railroad, 150 feet south of house, opposite mouth of Holly River, in outcrop of sandrock in bank; aluminum tablet stamped "943"	942.686
Bakers Run, 2 miles north of, south of railroad and river, 1 mile east of Holly River Junction, on outcrop of sandrock; chiseled square marked "914"	913.30
Gillespie Station, 0.5 mile south of, 40 feet south of mile-post "C 69 & R 53," east of railroad, west of county road, 430 feet north of road crossing, in east end of culvert; aluminum tablet stamped "890"	889.865
Gillespie, in front of station; top of rail	890
Gillespie, 0.5 mile north of, on edge of county road near summit, on outcrop of sandrock, chiseled square marked "930"	929.99
Gillespie, 1.2 miles northwest of, west of trail, opposite field, 0.2 mile south of house, on outcrop of rock, chiseled square; marked "886"	885.40
Gillespie, 2.2 miles northwest of, west of trail, on top of summit 0.5 mile west of house, in rock cliff; aluminum tablet stamped "945"	944.475

From point near Removal west along West Virginia Midland R. R. to Bakers Run.

Fuccy, ¼ mile southeast of, along highway, in boulder 10 feet west of road, west of fence; bronze tablet stamped "962"	961.652
Irwin, 0.3 mile west of, in rock north margin of track; bronze tablet stamped "924"	924.663

WEBSTER SPRINGS QUADRANGLE.

From Skidmore Crossing east along highway to point 1.5 miles northeast of Bergoo.

Skidmore Crossing, 400 feet east of, in boulder 10 feet north of track; bronze tablet stamped "1530"	1,530.116
Webster Springs, at north entrance of court-hourse, in east side of top step; bronze tablet stamped "1509"	1,508.740
Webster Springs, 1 mile southeast of, up Elk River road, in rock north end of foot-bridge over Elk River, chiseled square painted "1492.6"	1,492.41
Webster Springs, 2½ miles southeast of, 100 feet west of house of W. T. McCray, in boulder, south edge of road; chiseled square painted "1856"	1,855.60
Webster Springs, 3.6 miles southeast of, 0.7 mile south of church at Ralph, in rock, north edge of road up Elk River; bronze tablet stamped "1988"	1,987.260
Ralph, 1 mile east of, up Elk River road, in rock south margin of road, west of run; chiseled square painted "1937.4"	1,937.07
St. Mary's School, 120 feet east of, 10 feet south of road center, in rock; bronze tablet stamped "1856"	1,856.082
Bernardstown, near mill, at road fork, in rock west side of mill stream; chiseled square painted "1709.4"	1,709.09

Feet

Bergoo post-office, 0.4 mile west of, in rock west margin of road; bronze tablet stamped "1840"..... 1,840.031

Bergoo post-office, at confluence of Elk River and Leatherwood Creek, at south side of ford, in rock; chiseled square painted "1812.1"..... 1,811.71

Bergoo, 1.5 miles east of, up Elk River, at road fork, in rock; chiseled square painted "1974.8"..... 1,974.32

From Upper Glade northeast along highway to Webster Springs.

Upper Glade post-office, in concrete walk to residence of H. F. Given; bronze tablet stamped "2426"..... 2,427.202

Upper Glade post-office, 1 mile east of, 660 feet south of road forks, east side of road, in stump; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2663"..... 2,664.09

Upper Glade post-office, 2.2 miles east of, north side of road, on outcrop; chiseled square marked "U. S. B. M. 2712"..... 2,712.83

Upper Glade post-office, 2.9 miles east of, 80 feet west of narrow-gage railroad crossing, east side of road, in outcrop; bronze tablet stamped "2461"..... 2,461.447

Upper Glade post-office, 3 9 miles east of, 300 feet north of narrow-gage railroad crossing, east side of road, on outcrop; chiseled square marked "U. S. B. M. 2654"..... 2,655.21

Bolair post-office, 75 feet east of, south side of road, in large boulder; bronze tablet stamped "2285"..... 2,285.932

Bolair, 1.1 miles north of, west side of road, on ledge; chiseled square marked "U. S. B. M. 2433"..... 2,433.76

Bolair, 2.1 miles north of, 6 feet south of Kingfisher Creek, on ledge; chiseled square marked "U. S. B. M. 2373"..... 2,373.91

Bolair, 3.3 miles north of, 150 feet north of gate, west side of road, in ledge; bronze tablet stamped "2288"..... 2,288.901

Webster Springs, at north entrance of court-house, in east side of top step; bronze tablet stamped "1509"..... 1,508.740

From Bolair east 10 miles along highways up Gauley River (leveled twice).

Bolair, 1.2 miles east of, north side of road, on outcrop; chiseled square marked "U. S. B. M. 2270"..... 2,270.55

Beaver Run Schoolhouse, 240 feet west of, 50 feet north of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2270"..... 2,270.82

Beaver Run Schoolhouse, 1.5 miles east of, north side of road, in boulder; bronze tablet stamped "2303"..... 2,304.135

Beaver Run Schoolhouse, 2.6 miles east of, north side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2332"..... 2,332.42

Beaver Run Schoolhouse, 3.9 miles east of, south side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. "2335"..... 2,335.27

Beaver Run Schoolhouse, 4.9 miles east of, about 0.5 mile east of Turkey Creek, north side of road in boulder; bronze tablet stamped "2343"..... 2,343.983

Feet

Beaver Run Schoolhouse, 5.9 miles east of, on north bank of river, opposite Bernard Baughman's house, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2365"..... 2,365.92

Beaver Run Schoolhouse, 7.1 miles east of, 90 feet east of old dam, north side of trail, in root of tree; copper nail, with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2412"..... 2,412.40

Beaver Run Schoolhouse, 7.3 miles east of, 500 feet east of M. N. Barbe's house, 6 feet south of river, in ledge; bronze tablet stamped "2415"..... 2,415.880

Beaver Run Schoolhouse, 8.9 miles east of, north side of trail opposite Big Run, in root of tree; copper nail with washer marked "U. S. B. M. 2501" (on single spur)..... 2,502.19

From Upper Glade southeast 12 miles along highway up Williams River.

Dyer post-office, 1.4 miles west of, about 420 feet east of Mills Mountain Schoolhouse, west side of road, in boulder; bronze tablet stamped "2216"..... 2,216.382

Dyer post-office, 120 feet east of, north side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2223"..... 2,223.91

Dyer post-office, 1.1 miles east of, north side of road, opposite house of B. F. Dunlap, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2240"..... 2,241.08

Dyer post-office, 2.6 miles east of, south side of road, in ledge; bronze tablet stamped "2264"..... 2,264.474

Dyer post-office, 3.7 miles east of, south side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2311"..... 2,311.57

Dyer post-office, 4.8 miles east of, north side of road, in root of tree: copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2304"..... 2,305.10

Dyer post-office, 6.4 miles east of, about 600 feet northwest of house of Jacob Mullens, about 150 feet north of apple tree, north side of fence, in ledge; bronze tablet stamped "2353"..... 2,354.006

Dyer post-office, 7.6 miles east of, about 1 mile above Jacob Mullen's house, where trail crosses creek, on boulder; chiseled square marked "U. S. B. M. 2384" (on single spur line)..... 2,384.88

From point 2.6 miles north of Richwood east 20 miles along log railroad (leveled twice).

North Bend, 4.6 miles east of, about 240 feet south of summit, east side of track on ledge; chiseled square marked "U. S. B. M. 3631"..... 3,632.95

Feet

North Bend, 5.9 miles east of, 150 feet north of switch, east of track, in stump; copper nail with washer stamped "U. S. G. S. W. Va. B. M.," marked "U. S. B. M. 3462".....3,463.59

North Bend, 7 miles east of, west side of track, in ledge; bronze tablet stamped "3329".....3,330.810

North Bend, 8.1 miles east of, south side of track, in stump; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 3211".....3,212.22

Dogway, 30 feet west of water-tank, south side of track, in root of stump; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 3099".....3,100.85

Dogway, 1.6 miles northwest of, 150 feet southwest of switch, in ledge; bronze tablet stamped "2911".....2,912.787

Dogway, 1.1 miles east of mouth of, north side of track, in root of stump; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked "U. S. B. M. 2974".....2,975.16

Dogway, 2.1 miles east of mouth of, east side of track, west side of river, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M." marked " U. S. B. M. 3030" 3,031.30

Dogway, 3.3 miles east of mouth of, 20 feet south of track, in large boulder; bronze tablet stamped "3090".....3,091.213

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